Market Microstructure and Day-of-the-Week Return Patterns

submitted by

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Abstract

This paper documents a major shift in market microstructure during the period 1990 through 1999. In particular, a dramatic change in the pattern of cash flows by individual and institutional investors is documented. The question becomes, what effect this change has on day-of-the-week return patterns for the Dow Jones Industrial Average, Standard and Poor's 500 index, and Standard and Poor's 500 index futures. I find Monday's return pattern has changed in the decade of the 1990's. Not only is Monday's mean return significantly large and positive for all indices, the entire anomalous pattern occurs from Monday's open to Monday's close – an intraday effect. In addition, I find evidence that trading volume is a factor in explaining the anomalous behaviour of Monday's returns. New York Stock Exchange trading volume is significantly lower on Mondays from the trading volume of other days of the week but the trading activity of individual investors is significantly higher. More recently, individual investors have increased their buying activity on Mondays relative to prior periods. Finally, Monday exhibits the largest returns in the first two trading hours when the Dow Jones Industrial Average returns are decomposed into hourly returns. The research emphasizes the dynamic nature of the time series patterns of stock returns and the suggestion day-of-the-week return patterns are not robust over time. Therefore, familiarity with market microstructure issues is just as important as the statistical techniques utilized.

Dedication

In loving memory of my daddy,
Raymond
and
With love to my mother,
Marie
My Children,
Joe, Michael and David
and my loving husband and best friend
Ed

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I would like to thank my parents for their unconditional love and support and for instilling in me the courage and confidence to become whatever I wanted, my children for their understanding of an absentee mom, and my husband for his unwavering support, love and guidance. They have all been a major part of this and all the other accomplishments in my life. I love them with all my heart.

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Chapter 1: Introduction and Significance of the Study

It is well documented in the academic literature that Monday's mean return pre-1990 is negative while returns for the other days of the week are positive with a significant difference.[1] The prior results are robust to the index used to measure stock returns like the Dow Jones Industrial Average (DJIA), Standard & Poor's (SP) 500 index, and the Center for Research in Security Prices (CRSP) equally weighted or value-weighted index. The current research utilizes the DJIA, SP 500 index and SP 500 futures for the period 1990 through 1999. Preliminary research for this thesis (see Maberly & Pierce, 2003) indicates a significant shift in Monday's return pattern circa 1990. In particular, Monday's return is unusually large and positive relative to mean returns for other days of the week. The 1990's are also marked with well-defined changes in market microstructure. For example, the popularity and growth of index funds and increased cash flow into mutual funds. In particular, a change in market microstructure is evidenced by a change in investor trading patterns and the increased cash flows by individuals into mutual funds.

Monday's return pattern has changed in the decade of the 1990's. There is a complete reversal in Monday's return pattern observed in the seminal work by French (1980) and Smirlock and Starks (1986) for the DJIA and SP 500 index. Not only is Monday's mean return significantly large and positive in the decade of the 1990's, but also the entire anomalous pattern occurs from Monday's open to Monday's close—an intraday effect.

The works by Miller (1988) and Lakonishok and Maberly (1990) suggest that this anomaly could be the result of individual investor trading patterns. All of this

[1] First documentation of the Monday effect appears in the book *Why You Win or Lose* by Fred C. Kelly published in 1930. Other seminal papers documenting a Monday effect include French (1980), Smirlock & Starks (1985) and Lakonisok and Maberly (1990).

research occurred in the pre-1990 period. If the relationship between returns and individual investor trading patterns has any validity, then there should be a reversal of the transaction patterns in the 1990's and the prior research is testable. Analysis of the NYSE volume data by day of the week for the period of 1990-1999 supports the conjecture by L&M (1990) that trading volume is a factor in explaining the anomalous behaviour of Monday's return.

Significance of the study

As alluded previously, research documents (i.e. see Maberly and Pierce, 2003) a significant shift in Monday's return pattern for the value-weighted SP 500 index over the 1990's. In particular, Monday's mean return is unusually high relative to mean returns for other days of the week, which is unexpected given the general consensus that Monday's returns are negative. Therefore, if the seminal research findings of a significant Monday effect of negative returns pre-1990 by French (1980) and Smirlock and Starks (1986) plus explanations offered for this phenomenon by Miller (1988) and Lakonishok and Maberly (1990) have any predictive validity, observed changes in day-of-the-week return patterns over the 1990's should correspond to observed changes over the 1990's in individual and institutional trading. If not, then the linkage between individual trading patterns and day-of-the-week return patterns as suggested by Miller and Lakonishok and Maberly are not supported in an out-of-sample test. If the current research supports a reversal of odd-lot trading patterns for the 1990's, then the additional empirical evidence supports a theory that investor behaviour is a partial explanation for return anomalies. According to Schwert (2002), "the key test is whether the anomaly persists in new, independent samples."

If a well-defined change in market microstructure is identified or a change in investor trading patterns then the prior research is testable. Transmission mechanisms by which individual trading patterns influence calendar time anomalies are not immutable over time. In particular, care must be taken when making out of sample inferences. Instead of a direct effect, individual and institutional trading patterns could have an indirect effect. For example, index funds became very important in the 1990's (a change in market microstructure) as evidenced by the Vanguard SP 500 Index Fund.[2] The Fund grew from $1 billion in assets in the beginning of the decade to $115 billion by the end of the decade when the fund operated as the largest mutual fund in the world. The time lag between money flows in and out of index funds is, for all practical purposes, zero as opposed to a variable lag present in other mutual funds. For index funds, there is a tendency to hold zero cash balances. The objective of an index fund manager is to "track" returns to the underlying index. However, a more realistic objective is to minimize tracking errors. The U.S. Securities and Exchange Commission (SEC) requires that domestic mutual funds value their portfolios based on the 4:00 pm EST price, which corresponds to the closing of the New York Stock Exchange (NYSE). Thus to minimize tracking errors, index fund managers time their purchase (sales) near the 4:00 pm EST close of the NYSE. The hypothesis is that large cash inflows into SP 500 index funds on a particular day will be reflected in unusual large and positive returns over the last 30 minutes of trading on that day and conversely for large cash outflows.

Research Questions

Data will be collected and analysed to answer the following research questions:

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[2] For additional discussion on the increased importance of index funds see the Cash Flow and Security Returns section of the literature review.

1 Is there evidence that there has been a change in the market microstructure in the period 1990-1999?

2 Is there a significant difference in Monday's return pattern for the SP 500 index and DJIA over the decade of the 1990's versus that reported by prior empirical studies – French (1980) and Smirlock and Starks (1986)?

3 Are anomalous end-of-day (or intraday) return patterns evident for the DJIA over the decade of the 1990's? If yes, are these patterns consistent with a change in market microstructure?

4 Is there a significant difference in Monday's NYSE volume and Monday's NYSE odd-lot volume over the decade of the 1990's versus that reported by prior empirical studies – Lakonishok and Maberly (1990)?

Thesis Overview

The thesis is organized into five chapters. Chapter 2 summarizes the previous literature relevant to the study. The chapter includes thorough discussions on market anomalies and the seminal research papers on which this thesis is based.

Chapter 3 details the methodology used to answer each of the individual research questions. The chapter includes thorough descriptions of data collection and descriptive analysis methods. The day-of-the-week, Monday, univariate ARMA-GARCH, volume and inter-day models are presented.

Chapter 4 presents the empirical results relevant to each research question. The chapter is divided into sections based on each research question. Within the sections, results of the analysis, discussions on the findings and the implications are presented.

The final chapter presents the overall conclusions and implications of the research. Finally, discussions of the areas of further research are identified.

Chapter 2: Literature

Efficient Markets

Financial markets are a fertile source of academic research. In the 1960's the efficient markets paradigm was developed as a tool to model equity markets, but in particular the behaviour of equity prices. The Efficient Market Hypothesis (EMH) in its simplest form states that stock prices fully reflect all available public information in an unbiased fashion. According to Barberis and Thaler (2002) prices are unbiased and there is "no free lunch" in an efficient equity market; agents are rational, there are no frictions; and a securities price equals its fundamental value. The standard procedure is to delineate the EMH into three forms conditional on partitions of the information set. These partitions allow meaningful tests of EMH where the data set is restricted. The partitions include:

- Weak form (predictability) states that past prices and volume contain no information about future changes and price changes follow a random walk (Fama, 1991).
- Semi-strong form (event studies) states prices reflect all publicly available information (Fama, et al. 1969; Ibbotson 1975; Jensen and Ruback 1983).
- Strong form (insider information) states all private information is reflected in prices so that insider trading is not profitable (Fama 1991).

Fama (1991, 1998) surveyed the academic literature and found general support for the weak and semi-strong efficiency but very little evidence that markets are strong form efficient. In addition, Fama's research indicates that a joint hypothesis model generating prices must be specified or you could reject the model and not necessarily EMH.[3]

The EMH reached its pinnacle in the 1970's. In a world exhibiting rational expectations, asset-pricing models like the EMH were combined with economic fundamentals using rational expectations to bind the theory (Merton, 1973; Lucas 1978; Breeden 1979). However, the 1970's also marked the publication of numerous empirical studies identifying patterns in stock returns, so-called market anomalies that were totally unexpected under the EMH theory.

In the 1980's, the documentation of numerous unexplained patterns in stock returns caused a serious academic discussion on the consistency of the efficient market model. For example, financial economists have documented many calendar related anomalies including:

- Month of the year – January effect.
- Day of the week effect – Monday effect.
- Exchange closures - Holiday effect.

Return patterns based on calendar time are usually considered small departures from the fundamental truth of market efficiency. The literature supports systematic

[3] The joint hypothesis model requires both specifying the model of price generation and testing the EMH. The most fundamental procedure is stating that price changes follow a random walk. If price changes follow a random walk, then the implication is that the market is efficient, but the reverse need not be true. In particular, price changes need not follow a random walk for the market to be efficient. Assume that stock prices follow a time-series process of the form $P_{t+1} = P_t - e_{t+1}$ where successive error terms are independent of all past outcomes. If the variance $\sigma_t(e_{t+1})$ is constant, then prices are said to follow a random walk, a random walk with drift whenever $E(e_t)$ is non-zero. More generally, prices follow a martingale process by relaxing the assumption that the variance $\sigma_t(e_{t+1})$ is constant. Therefore, a random walk is a special case of a martingale process where the price change is drawn from a fixed distribution. A martingale process allows the higher moments of the distribution to be a function of past observations. The word martingale is derived from the French word *martingues*, which is a city in Provence. As the story goes, the people of Martinique favoured a betting strategy consisting of doubling the stakes after each loss. Thus a betting system with a zero expected payoff but where the variance of the payoff is a function of past outcomes represents a Martingale.

patterns in mean returns, variability of returns, bid-ask spread, and trading volume. However, a major puzzle has surfaced; the patterns are not predicted by any existing theory. The EMH implies that the market has no memory, so returns should be independent of calendar periods.

In general, recent research has emphasized that the aggregate market appears to be inefficient, but individual stock prices appear to adhere to efficient market theories (Shiller, 2002). In other words, the markets are micro efficient but macro inefficient.[4] During the 1980's, there have been many efforts to defend the EMH, but the existence of quite substantial "noise" in the markets overshadows the endeavours.

Advent of Behavioural Finance

As the 1980's drew to a close, financial economists were still pondering the discrepancy between the actual behaviour of asset prices and the behaviour predicted by the EMH. Past research on asset pricing placed a tremendous importance on quantitative analysis or number crunching, but virtually no emphasis on human behaviour as one of the explanatory variables. This observation led many academics to a very important question. Since we know that humans are involved in the marketplace, how does this involvement affect the market outcomes? EMH ignores human factors in analysis. Dehumanised analysis suggests that computers run the markets. Without this assumption, it would be hard to refute the idea that people make a difference.

The idea that investor sentiment affects markets is not new. Value investors proposed that markets over react to negative news. Benjamin Graham and David Dodd in their classic book *Security Analysis* (1934) asserted that over reaction was the

[4] In a private letter to John Campbell and Robert Shiller, Paul Samuelson declared the stock market was "micro efficient" but "macro inefficient." For a full discussion on the Samuelson dictum see Jung and Shiller (2005).

basis for a value investing style. In addition, feedback theory or price-to-price feedback theory has been prevalent in the popular media for a long time. The theory holds that when prices go up, public attention is attracted and expectations are elevated to believe that there will be additional price increases. This results in another round of increases. If this loop continues, it can produce speculative “bubbles.” These high prices cannot be sustained, so the bubble eventually bursts and prices fall. The theory works in the opposite direction for falling prices. The 1841 work of Charles Mackay, *Memoirs of Extraordinary Popular Delusions*, describes the speculative bubble in tulip bulbs in the 1630’s that read like a description of the feedback theory:

> *Many individuals grew suddenly rich. A golden bait hung temptingly out before the people, and one after another, they rushed to the tulip marts, like flies around a honey-pot. …. At last, however, the more prudent began to see that this folly could not last forever. Rich people no longer bought the flowers to keep them in their gardens, but to sell them again at cent per cent profit. It was see that somebody must lose fearfully in the end. As this conviction spread, prices fell, and never rose again. (pp. 118-119).*

Another example of word-of-mouth and media working together is the internet stock market bubble of the late 1990’s. If this occurs on large scales, it is reasonable to believe that it occurs at a smaller scale – daily stock price movements. Feedback may be an essential source of much of the apparently inexplicable lack of “randomness” that we see in financial market prices.

EMH assumes rational behaviour by participants (brokers, analysts, investors and traders). However, we need to be concerned with how real participants behave.

This has led to the advent of behavioural finance research. Two important studies marked the beginnings of the new paradigm. An article by De Bondt and Thaler (1985) identified a new anomaly called representativeness or the idea that investors become overly optimistic about recent winners and overly pessimistic about recent losers. This overreaction opposes the EMH ideal of regression to the mean. Additionally, Shefrin and Statman (1985) identified a disposition effect that suggests investors relate to past winners differently than past losers.

Thaler (1993) calls behavioural finance simply “open-minded finance.” Social sciences and finance have combined their knowledge in order to understand or find a solution to the EMH debate. It becomes necessary to accept the possibility that all the players are not fully rational, all the time. Behavioural finance argues that changes in fundamental value are influenced by the presence of traders who are not fully rational.

Behavioural finance studies how financial decisions are made or the study of human fallibility in competitive markets (Shliefer, 2000). This is an area that has been completely ignored by the economists of the 1960’s. Behavioural finance has begun developing models of human psychology as it relates to financial markets and decision-making. The foundations for behavioural finance lie in the bounded rationality work of cognitive psychologists that document how humans form expectations and make choices. Of crucial importance in this body of research to financial markets is how participants form expectations. According to Barberis and Thaler (2002), cognitive research has shown that participant beliefs are influenced by:

- Overconfidence in judgment
- Optimism
- Representativeness

- Conservatism
- Belief perseverance
- Anchoring
- Availability biases

These beliefs and preferences have led to modelling financial markets with less than fully rational participants by relaxing the assumption of complete rationality through the belief formation process or through the decision-making process. According to Shliefer (2000), behavioural finance has two foundations: limited arbitrage and investor sentiment. It is important to understand that behavioural finance is still in its infancy and lacks a complete unifying model (Shliefer, 2000). In addition, there is no single unifying model in behavioural finance.

Behavioural finance rests on an important question: are equity valuation errors systematic and therefore predictable? EMH advocates believe that price changes follow a martingale process, of which a random walk is a special case, though prices fluctuate to extremes, they revert back to equilibrium in time.[5] According to the behavioural finance view investors push prices to unsustainable levels in both directions and prices are a future estimate of what investors expect tomorrow's price to be. The presence of behavioural phenomenon in the markets is important and hard even for critics to dismiss. Critics however believe there is a large gap between documenting the existence of behavioural phenomena and convincing researchers that the use of current behavioural finance research methodologies improve the research program in financial economics. According to Zwiebel (2002), the most important critique of behavioural finance is its empirical testability. He claims it is not the lack

[5] Refer to footnote 2 for a discussion on martingale return generating process.

of testable implications, but the abundance. Because there are so many behavioural models, there seems to be an explanation for any deviation from efficient markets.

Anomalies

Anomalies can only be defined in relation to a model of "normal return behaviour." In general, they are empirical results that seem to be inconsistent with maintained theories of asset-pricing behaviour. They typically indicate market inefficiencies or inadequate pricing models.

The cross-sectional differences or anomalies that have been found are numerous and varied and include:

- Size and Value Effects: smaller size firms have higher returns than firms of larger size. For a discussion see Ibbotson & Sinquefield, 1982; Basu, 1977 and 1983; Banz, 1981 and Schwert, 1983 and 2002; Lewellen, 2002 and Fama & French, 1993 and 1996.
- Seasonality in Stock Returns: seasonal patterns in stock returns including the January effect and day-of-the-week effect or Monday effect (see Keim, 1983; Reinganum, 1983 and Booth & Keim, 2000.)
- Momentum Effect: includes contrarian's effect and continuation effect (see DeBondt & Thaler, 1985 and Fama & French, 1996; Jegadeesh & Titman, 1993.)

In addition, researchers have looked at combinations of the anomalies and the returns to different types of investors (individuals and institutional).

It is also important to address the relevance of an anomaly. Jensen (1978) highlighted the extreme importance of trading profitability when assessing market efficiency. If the behaviour is not strong enough to outperform a buy and hold strategy on a risk-adjusted basis, then it is not economically significant. Even if the behaviour is profitable, more recent return data shows that the anomaly is not robust to the passage of time and alternate research methodologies (Maberly and Pierce, 2003). Transaction costs, taxes and other market microstructure issues must be looked at to determine the relevance of research into deviations from normal return behaviour. [6]

In recent years, there has been tremendous growth in the documentation of unusual findings. Some argue that this is due to the existing bias to unusual findings in the publication process (Schwert, 2002). Others contend it is due to data snooping or looking for data with surprising results. The key test will be whether the anomaly persists in independent studies or the post publication performance. In this paper, research on the regularities in trading patterns of individual and institutional investors as an possible explanation for the day-of-the-week effect or Monday effect will be investigated and extended to see if the anomaly persists in an independent data set.[7]

January Effect

The January or turn-of-the-year effect was first documented by Rozeff and Kinney (1976) as the phenomenon that stock returns are higher, on average, in January. The phenomenon is well documented in the literature (e.g. Haugen and Lakonishok, 1988; Peavy, 1995; Reinganum, 1983; and Ritter, 1988). There have been several explanations offered for this anomaly, but the tax-loss selling (Badrinath and Lewellen, 1991; Brauer and Chang, 1990; Poterba and Weisbenner, 2001, D'Mello et al, 2003) and window-dressing explanations (Ritter and Chopra, 1989; Lakonishok and Smidt, 1986 and Musto, 1997) have the strongest empirical support. The tax-loss selling hypothesis claims investors sell the stocks that they have losses in

[6] According to O'Hara (1995), "market microstructure is the study of the process and outcomes of exchanging assets under explicit trading rules."
[7] For a definition and discussion on the day-of-the-week anomaly see the "Day-of-the-week" section of this paper.

before the end of the year for income tax purposes. This selling causes prices to be depressed in December. In January, the stocks are repurchased and prices rise (see Starks, Yong & Zheng, 2003 and Koogler & Maberly, 1994). Window-dressing refers to the selling activities of portfolio managers before they disclose their holdings. They tend to sell off the losing stocks to avoid disclosing that they have put a losing position in the portfolio. In this research, to make sure that the day-of-the-week and Monday effects are not being influenced by the well-documented January effect, it will be necessary to look at the interaction.

Holiday Effect

The work of Ariel (1990) and Lakonishok and Smidt (1988) provide significant evidence of the holiday effect. The holiday effect is the empirical observations that mean returns are unusually large on the trading day immediately before exchange holiday closings. Amazingly, the studies found that about ten pre-holiday trade days each year generated half of the total market gains in the period 1897-1986. With the sheer magnitude of these results, it will be important to make sure that the calendar anomaly being studied in this research is segregated from the potential impact of other calendar anomalies particularly with the number of 3-day weekends that occur in the recent periods. [8]

Day-of-the-week and Monday Effect

Numerous empirical studies report that returns are a function of the day of the week and include French (1980), Rogalski (1984), Smirlock and Starks (1986),

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[8] In order to help the U.S. economy, the Uniform Holiday Bill was passed by Congress in June 1968 to insure three-day weekends for Federal employees by celebrating four national holidays on Mondays – Washington's Birthday, Memorial Day, Veterans Day and Columbus Day. Richard Nixon declared one federal public holiday honouring all past presidents (Presidents Day) in 1971. An additional Monday holiday was instituted for Martin Luther King, Jr. The market is closed on the Monday holidays of Presidents Day, Memorial Day, Labor Day and Martin Luther King, Jr. Day. It should be remembered that in addition to the Monday holidays, traditional holidays (Christmas, New Years and Independence Day) could fall on Monday

Connolly (1989), Hiraki, Maberly and Park (1994) and Wang, Li and Erickson (1997) to name a few. French (1980) reported that Monday's average close-to-close returns over the period 1953 through 1977 were negative and significantly different from the rest of the days of the week. This phenomenon is often referred to as the Monday effect.[9] It is important to distinguish the Monday effect from the day-of-the-week effect, which is concerned with the patterns in returns across the days of the week and not on any particular day. In general, the early research suggests that stock returns are negative on Monday and significantly different on Monday from other days of the week (French, 1980; Gibbons and Hess, 1981; Lakonishok and Levi, 1982; Keim and Stambaugh, 1984, and Johnston, Kracaw and McConnell, 1991.) Later it was determined (Rogalski, 1984) that the negative returns on Monday for high capitalized stocks occurred from Friday's close to Monday's open and should be called a "weekend" effect. Rogalski collected opening prices for the Dow Jones Industrial Average (DJIA), which allowed him to distinguish between the trading and non-trading periods. He found that the negative returns observed for Monday returns occurred overnight after 1974.[10] Connolly (1989) reported evidence that the weekend effect had disappeared in returns after 1975 and that the results were not robust to

[9] Referred to as the "traditional" Monday effect.

[10] Dow Jones & Company, purveyors of the Dow Jones Industrial, Utility and Transportation Averages, publishes intraday index values for all three, and this information is reported in both *The Wall Street Journal* and *Barron's Magazine*. Of particular importance, Dow Jones reports opening values for the DJIA based on two sets of measurements. The actual opening value is based on the last trade price for each of the 30 DJIA component stocks as of 9:31 AM, which is one minute after the New York Stock Exchange opens. If a stock has not traded by 9:31 AM, then the previous day's closing price is used. Therefore, there is a high probability that the actual opening for the DJIA is contaminated by stale quotes. The theoretical opening value is based on the first trade of the day for each of the 30 DJIA component stocks no matter when it occurs and does not suffer from the stale quote problem associated with the actual opening. The theoretical DJIA opening value is therefore the preferred proxy for the DJIA opening value. The introduction of closed-end index funds beginning with the "spiders" (SP 500 closed-end fund) in 1993 and the "diamonds" (DJIA closed-end index fund) in 1998 provide an alternative proxy for the opening price of the SP 500 index and the DJIA).

econometric techniques.[11] Hiraki, Maberly and Park (1994) argue that spillover effects from Tokyo to New York are related to day-of-the-week return patterns observed in New York. When the Tokyo Stock Exchange is open for trading the New York Stock Exchange is closed and vice versa with Tokyo the first market to begin trading each day. In particular, Monday trading in Tokyo generates new information, but this information should be reflected in Monday's (New York) opening prices and so forth for the other days of the week. The authors find that the empirical evidence is consistent with theory Tuesday through Friday but on Mondays negative returns in Tokyo are associated with negative trading period returns in New York. Since trading does not overlap between New York and Tokyo, international asset pricing models predict that mean spill over effects from Tokyo only impact overnight New York returns. The finding by Hiraki et. al. that Monday's trading period return in New York is related Monday's return in Tokyo is a violation of the results predicted by International Pricing Models.[12] The authors offer no explanation for this anomaly.

More recent studies have documented that the Monday effect has disappeared in the U.S. markets (see Chang, Pinegar, and Ravichandran, 1993; Dubois and Louvet, 1996). Mehdian and Perry (2001) document the "reversal" of the Monday

[11] Connolly's results are ambiguous in that he only examines close-to-close returns. Close-to-close returns are associated with the Monday effect while close-to-open returns are associated with the weekend effect. Thus, Connolly (1989) examines the robustness of the Monday effect and not the weekend effect to alternative econometric techniques. Prior research shows that after 1974 the negative returns associated with the Monday effect are concentrated in the Friday close to Monday open period, at least for high-capitalized indices like the DJIA. Another potential critique of Connolly's methodology is that he delineates his data set into 3-year sub-periods with the first sub-period January 1975-December 1977. It should be noted that year-end 1974 marks the end of a severe bear market precipitated by the 1973 Arab oil embargo. Equity returns are unusually high in both January 1975 and January 1976 as reflected by the 12.51% and 11.99% return for the SP 500 index and 27.67% and 26.84% return for small company returns. Connolly incorrectly rejects the null hypothesis that the weekend effect is robust to alternative econometric techniques and publication of his paper is an example of the "file drawer problem." DeLong and Lang (1992) discuss the file drawer problem and argue many published papers in empirical economics get published because the authors commit Type I errors.

[12] For a discussion on the International Asset Pricing Model see Stulz (1981), Solnik (1983), Errunza and Losq (1985) and Cho et al. (1986).

effect in U.S. equity markets. They found Monday returns in the post-1987 period to be positive and significantly different from the other days of the week in both large cap (NYSE, S&P500 and DJ Composite) and small cap stocks.[13] Brusa, Liu and Schulman (2000) found the reverse Monday effect to be a unique feature of the U.S. markets with foreign markets still showing the traditional Monday effect or no effect at all.

This paper will examine the pioneering work of French (1980), which examines stock returns for different days of the week and the anomalous returns for Monday for the SP composite portfolio and DJIA from 1953 to 1977 and apply the analysis to the period from 1990-1999. In addition, the work of Smirlock and Starks' (1986) which examines the day-of-the-week effects using hourly data for the DJIA will be re-examined.

Many explanations have been studied or suggested to explain the traditional Monday anomaly. Miller (1988) suggests the Monday anomaly could be the result of individual investor trading patterns.[14] Miller claims two factors affect individual investors. First, individual investors have more time to make more decision over weekends so more trades are initiated on Monday. Second, the information received during the week from brokerages and analysts is biased towards buy recommendations. Over the weekend they do not get information from the brokerage firms so individuals have a higher tendency to initiate sell orders on Monday. Lakonishok and Maberly (1990) and Abraham and Ikenberry (1994) use odd lot trading as a proxy for individual trading patterns and support the individual investor hypothesis. Brooks (1997) uses the size of transactions as a proxy for both individual

[13] Referred to as the "Reverse Monday Effect."
[14] Referred to as the individual investor hypothesis.

and institutional investors. He finds that large-size trading activity as a proxy for institutions is significantly lower on Mondays and small-size trades as a proxy for individuals have a higher percentage of sell orders on Mondays.[15] However, Sias and Starks (1995) found institutional investors primarily drove the phenomenon. Of particular interest to this research is the paper by Lakonishok and Maberly (1990), which looks at the trading patterns of individual and institutional investors as related to the day of the week using odd-lot data as a proxy for trading by individual investors.

Lakonishok and Maberly (1990)

Lakonishok and Maberly's (1990) underlying premise is that individual investors make more transaction decisions over the weekend versus other days of the week. The data utilized included New York Stock Exchange (NYSE) trading volume and daily odd-lot transactions (odd-lot sales and purchases) for the period 1962-1986. Large block trades are the proxy for institutional trades and odd-lot trades the proxy for individual trading patterns. In addition, the dollar volume of sales and purchases of NYSE listed common stock by Merrill Lynch cash-account customers from November 1978 through May 1986 and NYSE block trades for the period April 1987 through October 1988 were analysed.[16]

Their analysis found overall trading volume on Monday decreases by more than ten percent. Monday's trading volume is significantly different from the trading volume for the remaining days of the week for the entire period 1962-1986. As a proxy of trading by individual investors, odd-lot transaction volume is used. The

[15] Concludes both individuals and institutions contribute to the negative returns with individuals contributing directly through their trading and institutional traders indirectly through their withdrawal of liquidity.
[16] Merrill Lynch is a leading Wall Street brokerage firm.

results indicated that individual investors are most active on Monday. However, the researchers find that odd-lot trading volume has decreased substantially over time.

Lakonishok and Maberly (hereafter L&M) offer no theoretical explanation why odd-lot buying should differ from odd-lot selling over any subperiod. Therefore, if odd-lot selling dominates in the 1962-82 bear market subperiod as found by L&M, then there is no theoretical reason why odd-lot buying would not be dominate in a subsequent bull market period.[17] This is an empirical question. The L&M paper implies Monday's return pattern is related to the observed odd-lot transaction pattern. The idea that buying and selling behaviour of individual investors may affect returns was first introduced by Ritter (1988) with reference to the January effect. Both papers suggest the buying and selling decision of investors are related to calendar time.

French (1980)

French looked at Monday returns through two models using the SP 500 composite index. The first model addressed is the trading time hypothesis that states returns are generated only during active trading. Since trading time is constant across the five days of the week, the trading time hypothesis predicts that returns should be equal across the days of the week The second model of the process generating stock returns is the calendar time hypothesis which models returns as a continuous process. The calendar time from Friday's close to Monday's close is three times that of the other days. Therefore, the calendar time hypothesis predicts that Monday's return should be three times larger that the returns for other days of the week. During the period of 1953 through 1977, return patterns are inconsistent with both models. French finds that the returns for Monday were significantly negative while the other

[17] Bear market is a period of time that is dominated by negative returns or below long-run average returns. Traditionally, a twenty percent or greater decline in the SP500 index is associated with a bear market. Conversely, bull markets are marked by positive or above long-run average returns.

four days of the week had positive returns. Once again, French offers no theoretical explanation for the anomalous Monday return patterns.

Smirlock & Starks (1986)

Smirlock and Starks (hereafter referred to as S&S) investigate the day-of-the-week and intraday effects in DJIA hourly stock returns over the 1963 through 1983 period. They find that the weekend effect has shifted from an interday phenomenon to an intraday phenomenon over time for high capitalized stocks. During the period from 1963 through 1968 the significant negative returns on Monday are attributable to negative returns during the trading day. In the period from 1968 through 1974, the significant negative Monday returns were found to be in the opening hour of trading and the remainder of Monday was positive. The final period of 1974 through 1983, Monday intraday returns were positive with only significantly negative returns in the first hour and from Friday's close to Monday's open. This research also rejects the trading time hypothesis over the pre-1974 period.

Cash Flows and Security Returns

There has been much research on the correlation between volume, price changes, and the direction of price changes (see Karpoff, 1987; Pfleiderer, 1984; Wang, 1994; and Blume, Easley, & O'Hara, 1994). From the research, it can be argued that a change in cash flow patterns would mark a change in market microstructure. Hale (1994) goes even further to say that the rise of mutual funds is creating a whole new financial system.

The 1990's have witnessed an enormous growth in mutual funds.[18] Mutual funds have existed in the U.S. since 1924, but the 1990's marked the beginnings of an

[18] Mutual funds operate as institutions that pool resources of numerous investors to invest in a diversified portfolio of securities (Remolona, Kleiman and Gruenstein , 1997).

extraordinary growth in the flow of funds into mutual funds by investors. The causal relationship between mutual fund flows and market returns has become an important topic of discussion in the popular financial press.[19] The popular press sees mutual fund flows as a measure of investor sentiment. Academics tend to offer other explanations for the relationship between mutual fund flows and returns. Much of the literature focuses on micro issues of cash flows into mutual funds or how funds compete with each other for investor's money.

The growing importance of index funds from September 1976 onward marks another important microstructure change. In September 1976 Standard and Poor's began to make public announcements of changes to the index. Prior to this period, no announcements were made as indexing was not popular. The announcement process usually took place on Wednesdays around 4:30 p.m. EST with the change becoming effective the next day. This continued until 1989, when Standard & Poor's acknowledged the important impact and changing role of index funds on the market. Indexes were causing increased order imbalances and volatility at the opening. To alleviate the problem, Standard and Poor's began pre-announcing any index changes on October 1, 1989.[20]

Warther (1995) takes a macro approach to the flow of funds.[21] Warther offers three possible explanations present in the literature to explain the relationship: information revelation by mutual fund flows, price pressures or investor sentiment, and feedback-trader hypothesis.[22] Warther looks at data from 1984 through 1992 and

[19] For examples see Norris (1996) and Gasparino (1996).
[20] For a complete discussion on index additions and deletions see Chen, Noronha & Singal (2003).
[21] Warther (1995) defines the macro level as the aggregate flows of funds into and out of the market without regard to which fund the money flows in to.
[22]The first two, information revelation and price pressure hypothesis deal with how fund flows affect returns. Information revelation deals with the perception that mutual funds possess or

documents strong correlations between monthly market returns and monthly aggregate mutual fund flows. He also found that fund flows are not related to general trading volume. However, Warther could not confirm either the price pressure hypothesis or the information effect as an explanation. Remolona, Leiman and Gruenstein (1997) look at a two-way causation between flows and funds and found net flows into mutual funds are highly correlated with market performance but the study suggest that the short-term effect is too weak to sustain a spiral effect up or down.

Intra-day market activity[23]

Edelen and Warner (2000) examine the relation between SP 500 index returns and aggregate flow into U.S. equity funds, using daily flow data for the period February 2, 1998 through June 30, 1999. They find that mutual-fund flow is correlated with concurrent market returns at a daily frequency. Although they find no material difference in flow across days of the week, they examine semi-weekly flow data from 1994 through 1998 and find evidence of higher beginning of month flows and returns. When the day's return is decomposed into early and late in the day components, there is virtually no association between concurrent flow and early returns: all of the daily association is attributable to late returns. They argue that trading in response to a day's flow is concentrated later in the day.[24] If there is to be a preliminary flow calculation intraday, it is efficient to do so late in the day, when the potential information is greatest yet it is still possible to be fully invested before the

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have access to information so their trades are associated with new information. According to Chen, Noronha & Singal (2003), the price pressure hypothesis "posits a downward sloping demand curve" in the short term. Therefore, demand causes a price movement to the upside causing investors to sell. When the demand is satisfied, then the upward price movement stops. For a thorough discussion of the price pressure hypothesis, see Harris and Gurel (1986). On the other side of the argument, the feedback-trader hypothesis contends that returns influence fund flows as investors chase returns.

[23] Intraday, in this case is open-to-close, close-to-open, and within-day (hourly) returns.

[24] This point becomes very important when looking at the hourly data for the DJIA.

market closes. This implies that returns in the afternoon should show a higher correlation with daily flows than returns in the morning. This, in part, is due to the fact that institutional traders place enormous importance on closing stock prices to calculate mutual fund net asset value. This is particularly important in relation to the trading behaviour of index funds. Index funds keep zero cash balances, so all cash inflows on day *t* are reinvested on day *t*. Since they have to match the index, they will be reinvested as close as possible to the end of the day.[25]

The work of Cushing and Madhaven (2000) found that the last five minutes of the trading day explains a disproportionate fraction of a stock's daily return. They found prices were more responsive to non-block order flow and that large block trades to total volume falls in the last five minutes. Their results support the view that end of day returns could be explained by the volume of trades along with the composition of that volume at the end of the day.

Institutional and Individual Investors

There is a strong interest in the literature for institutional trading and in particular on how institutional trades affect a stock's price (see Chan and Lakonishok, 1993, 1995, 1997; Keim and Madhaven, 1997; Jones and Lipson, 1999, and Saar, 2001). The general consensus is that institutional trading does have both temporary and permanent effects on stock prices.

In general, the research has shown markets have a different reaction to buy and sell orders with block purchases having a larger and more permanent impact than block sales. Prices will go up on buys and down with block sells, but there is a price reversal after sells and a price continuation after purchases. Explanations offered include inelastic supply and demand curves and information effects. Saar (2001)

[25] Additional support for this argument is found in Goetzmann & Massa (2003).

studies the profit-maximizing behaviour of institutional investors and finds the history of price performance influences the asymmetry of stock prices.

The work of Miller(1988), Lakonishok and Maberly (1990) and Abraham and Ikenberry (1994) suggests the Monday anomaly is at least partially explained by individual investor trading activity. In addition, Chan, Leung and Wang (2004) document the Monday seasonal is stronger in stocks with low institutional holdings while stocks with high institutional holdings show no significant differences across days of the week supporting the conjecture that the Monday anomaly is related to trading activities of individual investors. The work of Brooks (1997) uses intraday trades and size of transaction as a proxy for individual and institutional investors. The general findings of the study suggest that trading activity is significantly lower on Monday for large-size (institutional) trades effectively reducing liquidity. Small size trades (individuals) have a higher percentage of sell orders on Monday. The conclusion is that both individuals and institutions contribute to the Monday effect. The research strongly suggests that investor behaviour influences stock price behaviour.

Chapter 3: Methodology

The Data

A conjecture of this research is the weekend effect is not robust to market cycles so this study intentionally looks at only a bull market period.[26] The data employed in this study will consist of daily returns for the Standard and Poor's (SP) 500 index, SP 500 index futures, and Dow Jones Industrial Average (DJIA) for the period 1990 through 1999 taken from *Barron's Magazine*, *The Wall Street Journal* and the MRCI.com web site. The SP 500 index is a value-weighted index representing the daily total return of 500 large common stocks that are listed on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX) and NASDAQ. The DJIA is a price-weighted index representing 30 large U.S. firms listed on the NYSE or NASDAQ. The SP 500 index futures contract is traded on the Chicago Mercantile Exchange (CME) and is based on the SP 500 index. The futures contract is cash settled on the third Friday of each contract month. The contract is currently settled based on a theoretical Friday opening price for the SP 500 index.[27]

To look at the patterns or lack of patterns in intraday returns, the hourly returns will be collected for the DJIA for the period 1990-1999. In addition, daily NYSE trading volume (number of shares) and daily odd-lot sales and purchase transactions will be collected for the same period. The NYSE data will be collected

[26] For definitions, see footnote 17.

[27] The SP 500 index futures contract began April 1982. Initially the contract was settled at the end of the day but unusual price volatility was identified during the triple witching hour (final hour of the stock market trading session on the third Friday of March, June, September, and December, when stock, stock index and stock index option contracts expire. The simultaneous expirations often set off heavy trading of options, futures and the underlying stocks, which can cause large fluctuations in the value of their underlying stocks). The response by the SEC was to provide a new settlement price based on a "special" Friday opening price beginning with the July 1987 contract. SP 500 options switched to the special Friday opening price for settlement in 1992. See Herbst and Maberly (1990) for a discussion of the "special" Friday opening.

from the NYSE web site. The site covers all necessary time periods. Odd-lot transaction data are the only data available for a long period of time that records trades by individual investors. Odd-lot data will be collected from the *The Wall Street Journal* and *Barron's*. Individual investors do not trade only in odd lots; therefore, this data is only viewed as a proxy for the activity of individual investors.

Since the temporal behaviour of returns is the focus of interest, the study will utilize the continuously compounded rate of returns for the SP 500 index and DJIA. Since financial assets exhibit limited liability and multi-period returns are the product of normal single period returns and therefore not normal, the lognormal model for returns will be used.[28] The lognormal model utilizes the following formula:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

where R_t is a continuously compounded return on the asset price (P) over the time interval *t-1 to t.*

P_t represents the asset price at time *t, while*

P_{t-1} represents the asset price at time *t*-1.

Therefore,

$$P_t = e^{R_t} \text{ x } P_{t-1}.$$

Returns are found for close-to-close, close-to-open, open-to-close (intraday) and open-to-open trading periods. Close-to-close is defined as the close of day *t*-1 to the close of day *t*. Close-to-close is the returns used in most studies, but to obtain additional information as to what is causing the patterns, I have decomposed the patterns into open-to-close, close-to-open and open-to-open. Open-to-close is the intraday returns for day *t*. Open-to-close is impacted by information during the

[28] For a discussion on the lognormal distribution see Campbell et al. 1997.

trading day and any other portfolio adjustment decisions that result in buying and selling pressure. For example, during a time period with large cash outflows, then selling pressure should be reflected in the open-to-close return and conversely for buying pressure. Therefore open-to-close can be used to identify the relationship between returns and money flows. Close-to-open is the close of day *t*-1 to the open of day *t*. Close-to-open returns reflect all the information that has arrived since the previous days close and is used to identify the information effect on returns. Finally, open-to-open is defined as the open of day *t*-1 to the open of day *t*.

This decomposition is easily done for the DJIA and SP 500 futures. However, there is a problem with the opening price for any multi price index as the opening is calculated at a point in time (usually one minute after trading begins) so the reported opening index value is contaminated by stale quotes. Dow Jones & Co. mitigates the problem for the DJIA by calculating a theoretical opening.[29] SP 500 futures opening is the first trade of the day which you can think of as an unbiased forecast of the actual value of the index if all the stocks traded at the same point in time. However, the reported opening price of the SP 500 spot is based on the last reported trade. For this reason, SP 500 spot returns are only reported in this research on a close-to-close basis.

It is very important when calculating returns for the SP 500 index futures contract to correctly match prices with like contracts. There is not a continuous

[29] According to information provided by the Chicago Mercantile Exchange (CME), Special Opening Quotations (SOQ) generally differ from the opening index value for each index because all stocks do not open immediately. For example, on typical days surveyed by CME, most SP 500 stocks open quickly with around 95% open within fifteen minutes and 98% open with 30 minutes. Other indexes with larger numbers of stocks may take longer. SOQ of the indexes generally will be based on the opening values of the component stocks, regardless of when those stocks open on expiration day. However, if a stock does not open on that day, its last sale price will be used in the SOQ. The SOQ may or may not be within the cash index prices on expiration day. This is the same procedure used to calculate DJIA theoretical opening.

contract for SP 500 futures when you use the raw data. Therefore, you must have a switching strategy when to switch from the old contract to the new contract. The SP 500 index futures have contracts for March, June, September and December and they expire on the third Friday of the contract month. For example, the March contract expires on the third Friday of March therefore you have to switch observations from the March contract to the June contract prior to this date. The only exception to this rule is when there is a Friday holiday (i.e. Easter), then the preceding Thursday becomes the date of expiration. The paper takes the convention of switching on the last business day of February in this instance and similarly for the other contracts.

In order to insure the accuracy and reliability of the data and results, several exercises were performed including:

- filtering and graphing the daily return data based on percentage return and checking for any extreme positive or negative movements.
- Extreme daily return outliers (defined as +/-2%) were rechecked .
- Extreme outliers that were identified that coincided with major financial events. Dummy variables were used to mitigate the impact of outliers on return and volume patterns.
- Hourly data that was entered by hand was checked by a second reader for errors and the hourly returns filtered by percentage return to look for unusually large movements (defined as +/-.5%) and when identified rechecked for accuracy.
- Volume data was graphed and unusual patterns rechecked for accuracy.

Description of the basic analysis

For the return analysis, the study will utilize least squares (LS) and maximum likelihood (ML) estimation procedures to estimate day-of-the-week and Monday models. The covariance matrix and t-statistics computed by the LS procedure are robust to heteroskedasticity and autocorrelation in the disturbances without specifying a particular functional form for the process.

Any significant results would be stress tested for any assumption violations and their impact on the results. For instance, it is well known in the finance literature that return data is non- normal. Standard, robust econometric techniques will be used where appropriate.

Trend and unit root tests

The models used in this study assume that the variables in the system are stationary. Some series have to be made trend stationary or difference stationary. Time series for financial markets can have both stochastic and deterministic components. In fact, in most models of financial markets the unconditional expectation and variance of the *t*-th observation on the time series can be calculated (Alexander, 2001). The reason for looking at the stationarity of a time series is that the effects of a random shock to a stationary series are temporary, but the effects are permanent to a non-stationary series. To be stationary, the time series must have a mean and variance that is finite constant and the auto covariance depends only on the lag length and not on the value of the time index (Ward, 2005). The behaviour of asset prices and returns are very different. Prices tend to be non-stationary while returns are normally stationary. Prior research confirms both linear and non-linear time trends in a trading volume series (e.g., Gallant et al., 1992, Lee & Rui, 2002).

There are two methods for detecting non-stationarity. First, looking at the correlogram and graph of the series, and, second, a formal statistical test for unit roots.

To test for a unit root the Phillips-Perron (P-P) regression is employed. The P-P test was chosen because it is more robust to a wide range of serial correlation and time-dependent heteroskedasticity (Lee & Rui, 2002). The hypothesis tested is that a series has a unit root or is non-stationary. In addition the P-P test allows errors to be dependent with heteroskedasticity in the variance. They are more useful when the data have GARCH effects (Alexander, 2001).

To identify possible trends and volatility clustering due to anticipated and unanticipated events, which implies auto-correlation in the squared returns, times series of the returns graphs and correlograms will be developed.[30] In addition, to detect auto-correlation the first-order auto-correlation coefficient in squared returns will be calculated using the Ljung-Box Q test. The Ljung-Box Q statistic tests the hypothesis that autocorrelations of the returns and squared returns up to lag t are jointly zero. In addition, this test will help to identify the need to remove or "dummy out" any outliers to estimating any parameters for the GARCH model. In addition the test will identify whether there are any leverage effects in the data to help in determining the most appropriate GARCH model to utilize. [31] Both volatility clusters and leverage effects are accommodated in a GARCH model.

[30] Volatility clustering in markets is identified when there are periods of quiet small returns combined with periods of volatile large returns in financial market volatility. This is referred to as autoregressive conditional heterosckdasticity (ARCH).
[31] The leverage effect implies more volatility in a falling market than in a rising market. This implies an asymmetry in the volatility clustering of the data and an asymmetric GARCH model should be used.

Models

Day-of-the-week Model

The day-of-the-week model represents Monday versus each day of the week individually and is expressed as follows:

$$R_t = \beta_0 + \beta_1 Tu_t + \beta_2 W_t + \beta_3 Th_t + \beta_4 F_t + \varepsilon_t$$

where β_0 is a constant term identifying Mondays, Tu_t is a dummy variable where a Tuesday is given a value of 1 and a non-Tuesday a value of 0. This dummy variable set-up continues for each day of the week. Tuesday's mean return is represented by $\beta_0+\beta_1$ and so forth for the other days of the week. Therefore, β_1 represents the difference between Monday and Tuesday's mean return. An insignificant β_1 implies there is no difference between the two days.

Model Incorporating January Seasonal and Pre/Post Holiday Effects

Two well-documented capital market anomalies are the "January effect" (e.g. Starks, et al., 2003; Lakonishok and Smidt, 1988; and Koogler & Maberly, 1994; and Faff, 1992) and the holiday effect (e.g. Ariel, 1990 and Pettengill, 1989). The January effect claims, in the United States, January returns are, on average, abnormally high (Faff, 1992), but especially small firm returns are unusually high. The holiday effect is the observation that returns are unusually large relative to returns on all other days on the day preceding a holiday closing. With the sheer magnitude of the results for these calendar anomalies, it will be important to make sure that the calendar anomaly being studied in this research is not a result of the pre-holiday effect (particularly with the large number of market holidays that occurring on Monday over the decade of the 1990's)[32] or the January effect.

[32] For a discussion refer to footnote 7.

To investigate the potential interaction between the day-of-the-week and January seasonal, the day-of-the-week model is stated as follows:

$$R_t = \beta_0 + \beta_1 Tu_t + \beta_2 W_t + \beta_3 Th_t + \beta_4 F_t + \beta_5 J_t + \varepsilon_t$$

where the constant variable and day of the week dummies are the same as the above model and J_t is a dummy variable that equals one for January and zero otherwise.

To investigate the potential interaction between the day-of-the-week and holiday effects, the day-of-the week model is stated as:

$$R_t = \beta_0 + \beta_1 Tu_t + \beta_2 W_t + \beta_3 Th_t + \beta_4 F_t + \beta_5 H_t + \varepsilon_t$$

where the constant variable and the day of the week dummies are the same as the original model and H_t is a dummy variable that equals one for a pre/post holiday trading day and zero otherwise. In addition, the interaction with both anomalies is investigated using the following model:

$$R_t = \beta_0 + \beta_1 Tu_t + \beta_2 W_t + \beta_3 Th_t + \beta_4 F_t + \beta_5 J_t + \beta_6 H_t + \varepsilon_t .$$

Monday Model

The Monday model represents Monday versus all other days of the week combined and is expressed as follows:

$$R_t = \beta_0 + \beta_1 D_t + \varepsilon_t ,$$

where D_t is a dummy variable identifying Tuesday through Friday. If day-of-the-week is Monday then the value is 0 and for all other days the value is 1. The Monday seasonal is represented by β_0. β_0 is the intercept and represents the mean return for Monday's and mean return for Tuesday through Friday is given by $\beta_0+\beta_1$. R_t represents the daily return for day t, and the disturbances are denoted by ε_t. $\beta_0 + \beta_1$ represents the difference between Monday and Tuesday through Friday. A significant

β_1 coefficient indicates there is a significant difference between Monday and the day in question.

Model Incorporating January Seasonal and Holiday Effects

To investigate the potential interaction between the Monday and January seasonal, the Monday model is stated as follows:

$$R_t = \beta_0 + \beta_1 J_t + \beta_2 J_t M_t + \beta_3 M_t + \varepsilon_t \, ,$$

where J_t is a dummy variable that equals one for January and zero otherwise. J_tM_t is an interaction term between the Monday and January seasonal where the value is 1 if January and Monday and 0 for all other combinations. Weekend or Monday effects in January are measured by $\beta_1 + \beta_2 + \beta_3$ with β_3 measuring weekend or Monday effects for the rest of the year. The January seasonality is measured by β_1. The difference between Mondays in January and Mondays over the rest of the year is represented by β_2. The Monday return in January is given by $\beta_0 + \beta_1 + \beta_2 + \beta_3$ and the rest of the year is given by $\beta_0 + \beta_3$.

To investigate the potential interaction between the Monday and the holiday anomaly, the Monday model is stated as follows:

$$R_t = \beta_0 + \beta_1 J_t + \beta_2 J_t H_t + \beta_3 H_t + \varepsilon_t \, ,$$

where H_t is a dummy variable that equals one for a pre/post holiday trading day and zero otherwise. H_tM_t is an interaction term between the Monday and pre/post holidays where the value is 1 if a pre/post holiday trading day and Monday and 0 for all other combinations.

Univariate ARMA-GARCH Modelling

The return equation will be modelled as an ARMA(p,q) process, which refers to a model with p autoregressive terms and q moving average terms. This model subsumes the AR and MA models. An autoregressive model with the notation AR(*p)* refers to an autoregressive model of order *p* and can be written as

$$R_t = c + \sum_{i=1}^{p} \varphi_i R_{t-i} + \varepsilon_t \ ,$$

where R_t is returns at time t, and R_{t-i} are returns at time t-i, $\varphi_1 \ldots \varphi_p$ are the parameters of the model, c is a constant and ε_t is the error term. For example, an AR(1) process is given by:

$$R_t = c + \varphi R_{t-1} + \varepsilon_t \ ,$$

where ε_t is a white noise process with zero mean and constant variance σ^2.

A moving average model of order q or MA(q) is given by:

$$R_t = \varepsilon_t + \sum_{i=1}^{q} \varphi_i \varepsilon_{t-i} \ ,$$

where $\varphi_1 \ldots \varphi_q$ is the parameters of the model and the ε_t, ε_{t-1},… are the error terms.

The ARMA(p,q) model to be used in this research can be notated as:

$$R_t = c + \sum_{i=1}^{p} \varphi_i R_{t-i} + \varepsilon_t + \sum_{i=1}^{q} \varphi_i \varepsilon_{t-i} \ ,$$

where notations are the same as given in the AR(p) and MA(q) models.

ARMA models in general can, after choosing p and q, be fitted by least squares regression to find the values of the parameters, which minimise the error term. It is generally considered good practice to find the smallest values of p and q, which provide an acceptable fit to the data. First, the appropriate lags p and q have to be determined. The simplest method to do this is using correlograms. This is an estimate of the autocorrelation function based on empirical data. In addition, the optimal lag length time will be determined using information from the Akaike Information Criteria (AIC). The AIC is computed as:

$$\text{AIC}=-2(l/T)+2(k/T),$$

where k is the number of parameters in a regression model, estimated using T observations and l is the value of the log of the likelihood function. Smaller values of the AIC are preferred and you choose the length of a lag distribution by choosing the specification with the lowest value of the AIC.

Like skewness and kurtosis, autocorrelation increases with high frequency data. Therefore, the autocorrelation in residuals will be tested using the Ljung-Box Q statistics. The Q-statistic is computed as:

$$Q_{LB} = T(T+2)\sum_{j=1}^{k}\frac{\tau_j^2}{T-J},$$

where τ_j is the j-th autocorrelation and T is the number of observations. Under the null hypothesis, Q is asymptotically distributed as a χ^2 with degrees of freedom equal to the number of autocorrelations. If autocorrelation exists, then more lags will be added into the equation until autocorrelation disappears.

Empirical research has documented significant first order autocorrelation in daily stock returns.[33] Therefore, the default model is ARMA(1,0) unless evidence is found to support a higher-order process. Also, any model must have both statistical justification plus be based on sound theoretical arguments.

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[33] For example see the work of Campbell, Grossmen and Wang (1993).

As mentioned, on a daily bases, returns show signs of autocorrelation, so they are not independent. Mandlebrot (1963) observed that returns have periods of volatility interspersed with periods of calm. In other words, volatility comes in clusters. This is called autoregressive conditional heteroskedasticity (ARCH). It is apparent from Figure 9 (see page 92) that there is volatility clustering in the DJIA, SP 500 index and SP 500 index futures close-to-close returns. To accommodate the volatility clustering a generalized autoregressive heteroskedasticity (GARCH) framework will be used by extending the linear regression model with another equation called the conditional variance equation. The GARCH model focuses on the time-varying variance of the conditional distribution of returns. The conditional variance equations will be modelled using the standard GARCH(1,1) model. Empirical research has shown that the GARCH(1,1) specification is sufficient to model the variances of stock returns.[34] In addition, the data employed in this research has been intentionally chosen as a "bull market" period so the symmetric GARCH model will be used.

Normally it is only necessary to use the GARCH(1,1) model. The GARCH (1,1) model is equivalent to an ARCH model with exponentially declining lag coefficients, so the GARCH (1,1) models an infinite ARCH process. The 'vanilla' GARCH (1,1) model is specified in a general form by a mean equation:

$$y_t = x_t' \gamma + \varepsilon_t ,$$

and a conditional variance equation:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$$

[34] For example the work of Bollerslev (1987), Conrad et al (1991) and Bollerslev, Chou and Kroner (1992).

$$\omega>0,\ \alpha,\ \beta\geq 0$$

$$\alpha+\beta<1,$$

where ω is the constant, α is the error coefficient, β is the lag coefficient, ε_{t-1}^2 is the ARCH term and σ_{t-1}^2 is the GARCH term.

Equities often exhibit downward movements in the market followed by higher volatilities than upward movement of the same magnitude. To account for these leverage effects, Nelson (1991) proposed an exponential GARCH (EGARCH) model. The EGARCH model eliminates the need to place non-negativity constraint on the parameters by implementing a conditional variance in logarithmic terms. The specifications for the conditional variance equation of the EGARCH model as proposed by Nelson (1991) is:

$$\log \sigma_t^2 = \omega + \beta \log \sigma_{t-1}^2 + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}}.$$

Negative shocks to returns induce larger responses than positive shocks. EGARCH allows the conditional variance to respond differently to a decline versus an advance by allowing γ to be different from zero while ARCH and GARCH models impose a symmetric response. The EGARCH model does not impose any constraints on the coefficients of the variance equation to enforce nonnegativity of the variance.

The model parameters will be estimated by maximum likelihood (ML) as it produces consistent, asymptotically normal and efficient estimates (Bollerslev, 1987). The goal of maximum likelihood is to maximize the probability that the model accurately reproduces the data points. The advantages of the maximum likelihood model are:

- ML provides a consistent approach to parameter estimation;
- As the sample size increases, they become minimum variance estimators with parameter averages theoretically equal to the population;
- And they have approximate normal distributions.[35]

The EViews statistical package will be utilized to perform all operations for the ARMA-GARCH and EGARCH modelling. All of the analysis will include appropriate testing of the fit, normality and correlation.

[35] For a thorough discussion of ML see http://www.itl.nist.gov/div898/handbook/eda/section3/.

Volume Model

The procedure to represent the volume model will be similar to that used by L&M modified to fit the particulars of this study and the data used. Basically a one-way analysis of variance model will be utilized for the NYSE trading volume and both odd-lot sales plus (minus) odd-lot purchases as a percentage of NYSE trading volume data. The F-statistic will test the hypothesis that the mean trading volume on a particular day is equal to the average across the other four trading days of the week. The hypothesis that the mean trading volume across all days of the week is the same will be tested. In addition, the hypothesis that the mean trading volume across the four days of the week, excluding Monday, is the same will be tested.

Intraday Model

The procedure to represent the intraday effects in stock returns will be similar to that employed by Smirlock and Starks (1986). To test the possibility of day-of-the-week effects in hourly returns, the DJIA intraday mean return model is estimated using eight hourly return measures as dependent variables with a separate regression for each day of week. This regression does not have a constant term, so the number of dummy variables is equal to the number of time intervals. The regression equation is represented as follows:

$$R_t^i = \alpha_1 D_1 + \alpha_2 D_2 + ...\alpha_8 D_8 + \varepsilon_t,$$

where R_t^i is the percentage change in the DJIA on day t at time interval i. D_1 through D_8 are dummy variables for the time intervals across each day of the week. The dummy variables for the interval in questions are one and zero otherwise. Interval one, seven and eight are 30 minutes and two through six are one-hour intervals. The market opens at 9:30am EST and closes at 4:00pm EST. The exact intervals are as follows:

Dummy	Time interval EST
D_1	9:30am-10:00am
D_2	10:00am-11:00am
D_3	11:00am-12:00pm
D_4	12:00pm-1:00pm
D_5	1:00pm-2:00pm
D_6	2:00pm-3:00pm
D_7	3:00pm-3:30pm
D_8	3:30pm-4:00pm

The t-statistic will test if the mean returns are different from zero. The F-statistic will test the hypothesis that all the coefficients equal zero.

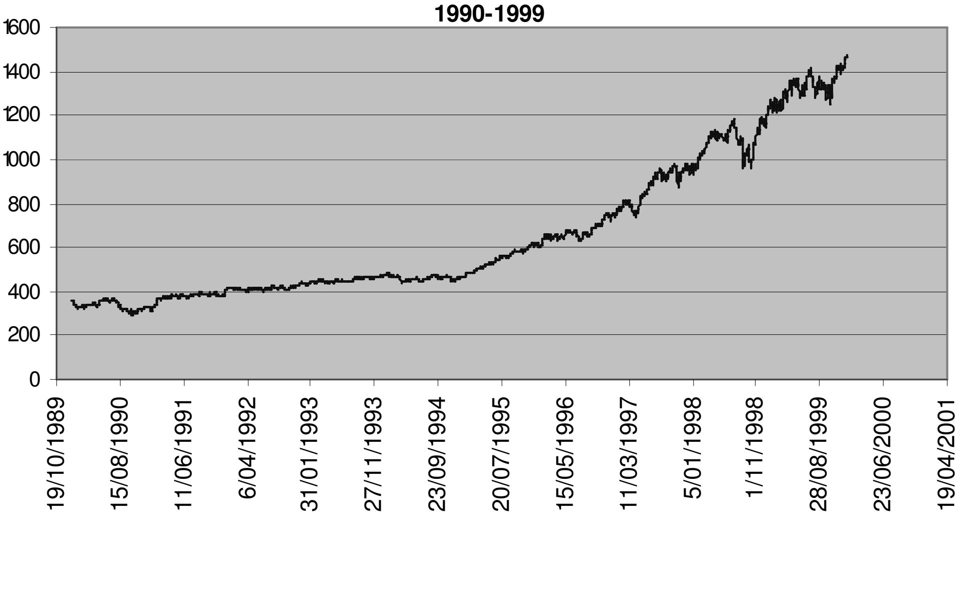
Chapter 4: Results

Question One: Is there evidence that there has been a change in the market microstructure in the period 1990-1999?

Evidence of a bull market.

The decade of the 1990's marks a period of unusually large returns unparalleled in market history. For example, the S&P 500 index increased from 353.69 at the end of 1989 to 1469.25 at the end of 1999 (see Figure 1). The over four-fold increase in the index over the 1990's represents an annual compounded total return over the decade of 15.31% and increases to 18.2% if dividends are included. As a comparison, the annual compounded return including dividends from 1926-2003 is 10.4%. As this includes the decade of the 90's, this makes the comparison more meaningful. [36]

Figure 1
Standard and Poors 500
1990-1999



[36] Total return includes both dividends and capital appreciation. The S&P 500 index is reported on an ex-dividend basis. The source for the data for total returns is the Ibbotson Year Book (2004). In particular see Table 2-1, p. 28 and Table B-1, p. 218.

Evidence of a change in market microstructure

There has been much research on the correlation between volume, price changes, and the direction of price changes (see Karpoff, 1987; Pfleiderer, 1984; Wang, 1994; and Blume, Easley, & O'Hara, 1994). From the research, it can be argued that a change in cash flow patterns marks a change in market microstructure. Hale (1994) goes even further to say that the rapid growth in the early 1990's of mutual funds is creating a whole new financial system.

Equity Mutual Funds

During the 1990's mutual funds became a much more important part of the financial system. Mutual fund assets grew at a 21.4 percent annual rate. Sixty percent of the growth is attributable to new investments and new funds (Reid, 2000). Growth of total net assets exceeded the $6.8 trillion mark by the end of the 1990 decade (see Table 1).

Figure 2 provides a visual comparison of the total net assets of equity funds and the S&P 500 index level across time. The figure reveals the close relationship between the steep rise in the market and the steep increase in net assets of equity funds particularly in the 1990's. For example, at year-end 1989 equity funds held $248.8 billion with the S&P 500 index at 353.40. At year-end 1999, the value of equity mutual funds stood at $4,041.9 billion, which represents an over 16-fold increase. In contrast, the increase in the S&P 500 index over the same period is only a four-fold increase. The bulk of the increases in assets of equity funds are due to increased cash inflows and not due to the increase in overall higher market valuations.

Table 1

Total Net Asset Value of Equity Funds vs. S&P 500 Index Level

Year	Total Net Asset Value: Mutual	Year End: S&P 500 Index Level
1970	45.10	92.00
1971	51.60	101.95
1972	55.90	118.05
1973	43.00	97.55
1974	30.90	68.56
1975	37.50	90.19
1976	39.20	107.46
1977	34.00	95.10
1978	32.70	96.11
1979	35.90	107.94
1980	44.40	135.76
1981	41.20	122.55
1982	53.70	140.64
1983	77.00	164.93
1984	83.13	167.24
1985	116.90	211.28
1986	161.40	242.17
1987	180.50	247.08
1988	194.70	277.72
1989	248.80	353.40
1990	239.50	330.22
1991	404.70	417.09
1992	514.10	435.71
1993	740.70	466.45
1994	852.80	549.27
1995	1,249.10	615.93
1996	1,726.10	740.74
1997	2,368.00	970.43
1998	2,978.20	1,229.23
1999	4,041.90	1,469.25

Note: Total net assets includes equity funds, bond and income funds and money market funds.

Source: Investment Company Institute

The retirement market is a major source of the increases in mutual fund activity particularly by participation of the baby boomers (born 1946-1964) in the 1990's. One third of all mutual fund activity can be attributed to defined contribution plans and individual retirement accounts during this period.[37] Of particular importance to this research are the net flows to equity funds as an indication of a change in market microstructure. There has been an actual decline in equity fund assets over the 1970's and a tremendous increase in both the net assets and number of shareholder accounts during the 1990's. In fact, there has been nearly a seven fold increase in the number of shareholder accounts between 1990 and 1999 with funds increasing nearly 17-fold and purchases of common stock increasing 8.78 times. Prior to the 1990's, net purchases of common stock by long-term mutual funds was predominately negative and if positive very small in magnitude. Overall, there has been a major change in the trend.

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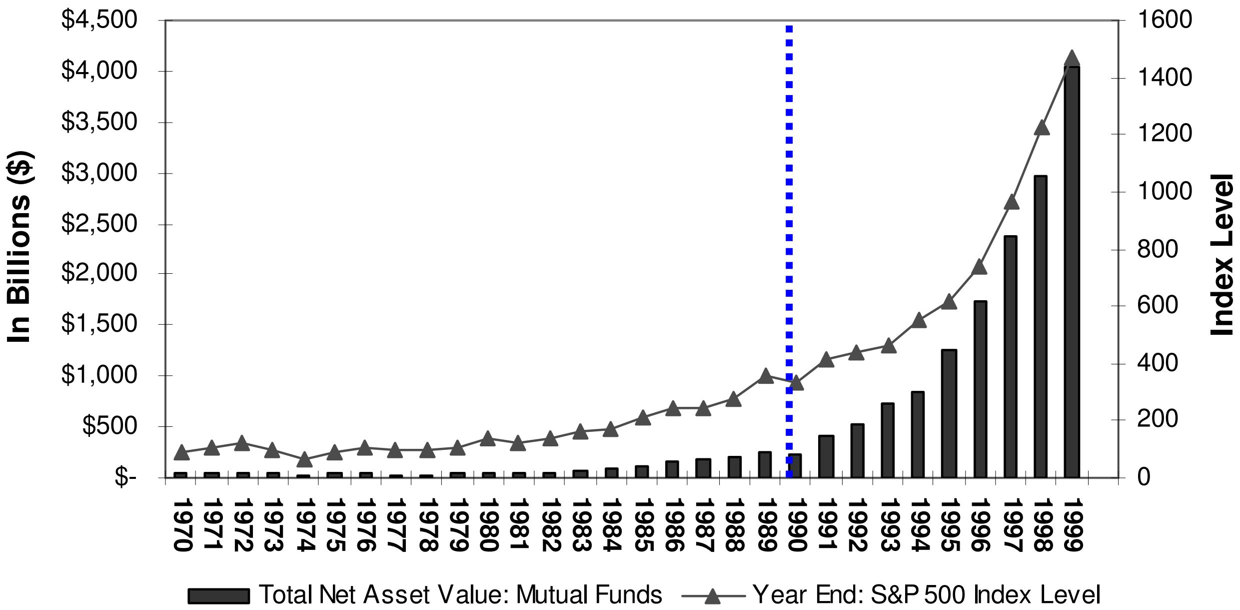
[37] A defined contribution plan refers to one in which the employer makes regular contributions of a specified amount of money. The plan does not promise the employees any specific amount of retirement benefits. The employee's benefit will depend on how much was contributed to the account, and how the plan's investments performed over the years. Examples of this kind of plan include a profit-sharing plan, a money-purchase plan, a target-benefit plan, stock bonus plans, and employee stock ownership plans (see print.employment.findlaw.com/employment/employment-employee-wages-benefits/employment-employee-wages-benefits-dictionary.html).

An IRA is a plan that offers tax advantages to save and invest for retirement. Contributions are often tax deductible in whole or in part, depending on individual circumstances, including compensation levels and participation in an employer sponsored qualified retirement plan. Income derived from investments in a traditional deductible or non-deductible IRA is tax deferred until withdrawn. Under certain circumstances, withdrawals from a Roth IRA are tax-free. Tax penalties may apply to IRA distributions taken before age 59 ½. The most you can contribute to your traditional IRA for 2002 has been increased to $3,000 or if you are 50 or older, $3,500. Keep in mind that contributions on your behalf to a traditional IRA reduce your limit for contributions to a 'Roth IRA' (see http://www.rbeck.com/ryan_beck2/invest_glosry_InInd.htm).

Figure 3 emphasises the potential relationship between the purchase of stocks in long-term mutual funds and the SP 500 index level over the time period of 1970 to 1999. You can see the exponential rise in both flows in the market and purchases of common stock by mutual funds beginning in the 1990's. Recent research has shown a close relationship between flows and returns using monthly flow data (see Warther, 1995; Goetzmann, Massa & Rouwenhorst, 2004; Edelen, 1999; and Edelen & Warner, 2001), and this will be discussed in more detail in question three of the results.

Figure 2
Total Net Assets: Equity Funds*
vs.
S&P 500 Index Level



* Equity funds include both foreign and domestic equity funds.

Source: Investment Company Institute

Table 2

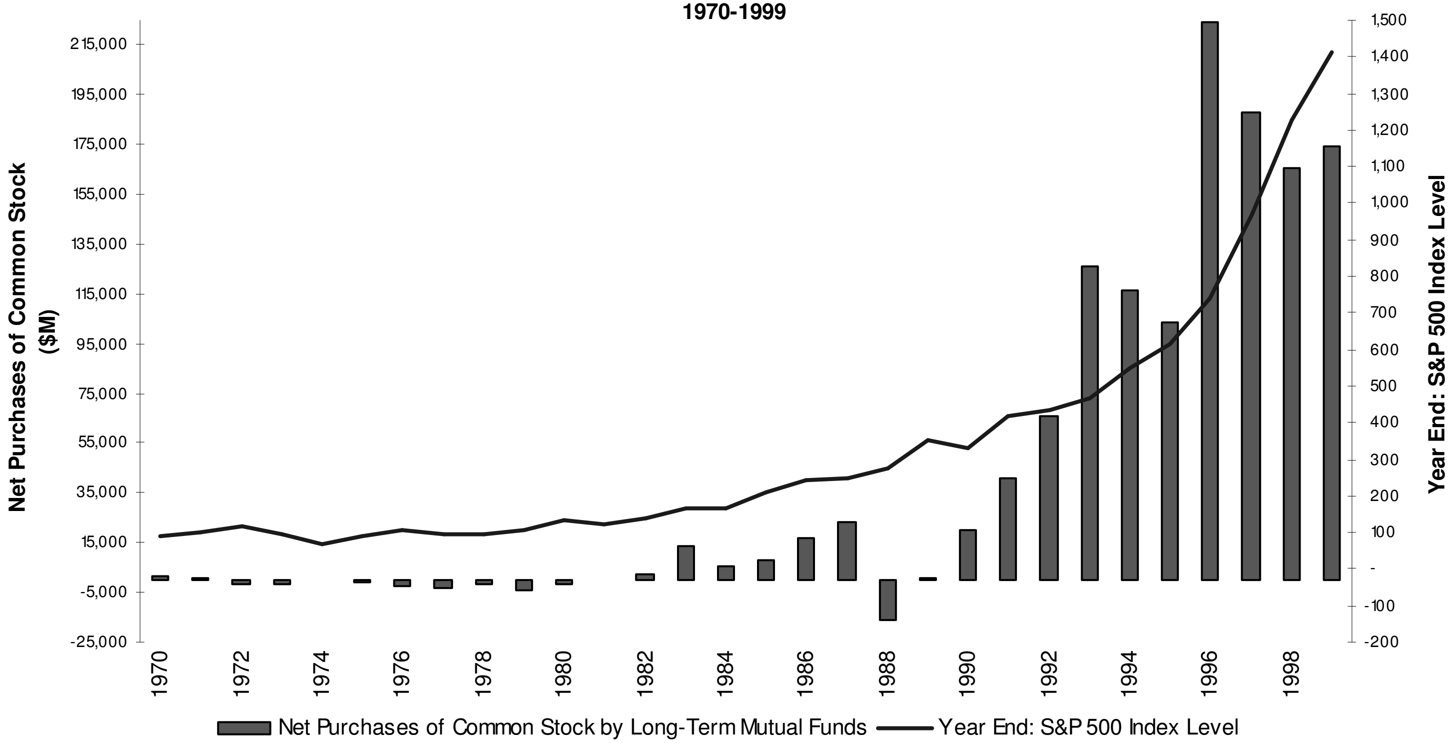
Summary of Industry Data

1990-1999

Year	Equity Fund Assets ($B)	Shareholder Accounts (M)	Net Purchases of Common Stock by Long-Term Mutual Funds ($M)
1970	45.1		1,226.8
1971	51.6		382.6
1972	55.9		-1,609.3
1973	43.0		-1,943.7
1974	30.9		-286.8
1975	37.5		-953.6
1976	39.2		-2,549.2
1977	34.0		-3,506.6
1978	32.7	6.8	-1,621.8
1979	35.9	6.1	-3,824.0
1980	44.4	5.8	-1,906.1
1981	41.2	5.7	-418.6
1982	53.7	6.2	2,457.6
1983	77.0	9.2	13,767.8
1984	83.1	8.6	5,692.4
1985	116.9	11.5	8,146.8
1986	161.4	16.0	16,426.4
1987	180.5	20.8	22,864.3
1988	194.7	20.1	-16,079.4
1989	248.8	20.8	1,076.5
1990	239.5	22.2	19,815.6
1991	404.7	25.6	41,009.7
1992	514.1	32.7	65,660.6
1993	740.7	42.3	125,867.3
1994	852.8	57.9	116,334.8
1995	1,249.1	69.3	103,304.8
1996	1,726.1	85.4	223,998.8
1997	2,368.0	101.8	188,400.9
1998	2,978.2	119.8	165,254.6
1999	4,041.9	149.0	173,961.7

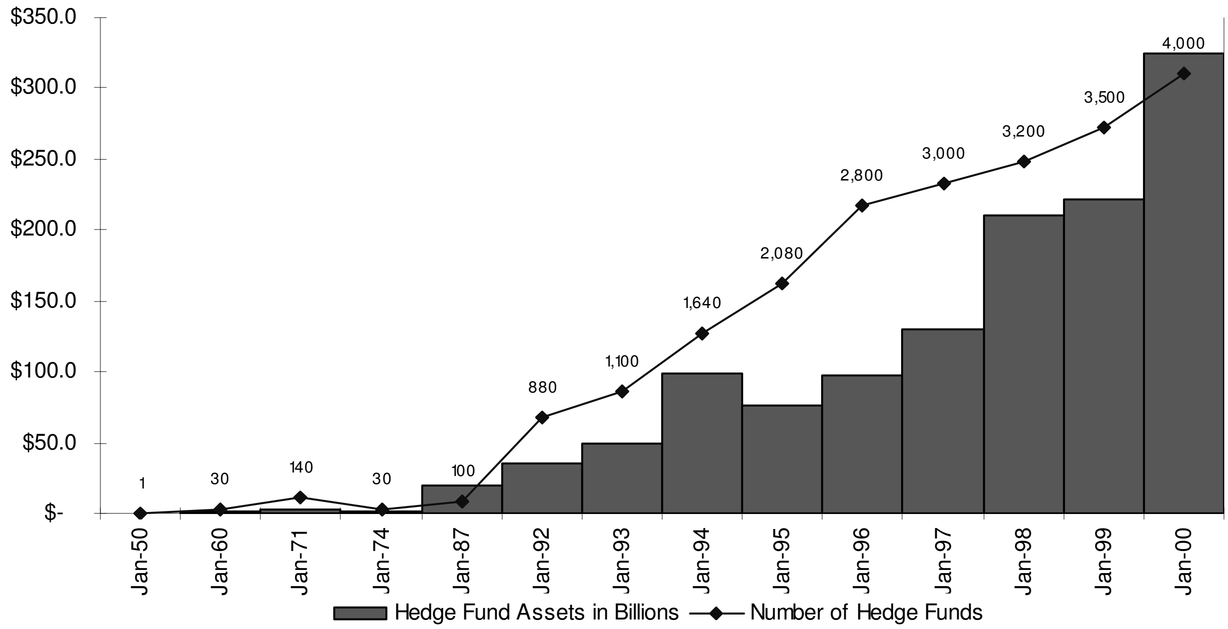
Source: Investment Company Institute

Figure 3
Total Long-Term Mutual Fund Common Stock Purchases
vs.
S&P 500 Index Level
1970-1999



Source: Investment Company Institute

Figure 4
Hedge Funds Assets vs. Number of Hedge Funds



Source: Hennessee Group LLC

Hedge Funds

Hedge Funds are unregulated investment vehicles traditionally utilized by wealthy investors. Unlike other funds, hedge funds are not regulated by the U. S. Security Exchange Commission, so they have no restrictions as to what they invest in and can take on any strategy. To be eligible to invest in hedge funds requires investors to meet a high income and liquid asset requirement. Figure 4 emphasises the increased importance of hedge funds with both an increase in number of funds and hedge fund assets. Hedge funds are leveraged, so the impact on the market is highly magnified. A good example of the effects of hedge funds on the market is the August 1988 failure of Long Term Capital Management (LTCM). The collapse of LTCM nearly caused a world wide financial panic and forced the Federal Reserve Bank of New York to intervene in the funds rescue.

It is apparent from the evidence provided this period marks one of the greatest bull markets in financial history. In addition, there has been a marked change in the market microstructure for the 1990-1999 period. In particular, the increased importance of index funds as an investment vehicle has changed the flow of funds into the market and by conjecture return patterns.

Question Two: Is there a significant difference in Monday's return pattern for the SP 500 index and DJIA over the decade of the 1990's versus that reported by prior empirical studies – French (1980 and Smirlock and Starks (1986)?

Preliminary Analysis

The analysis begins with an examination of the daily price data for the SP 500 spot and futures and DJIA. In order to fully understand the raw daily price and volume data collected and to identify potential errors and outliers, basic descriptive analysis is undertaken including scatter diagrams, moving averages, frequency distributions, means, medians and standard deviations.[38]

Average daily percent returns and associated *t*-values testing the hypothesis:

$$\begin{aligned} H_0 &: \mu = 0 \\ H_A &: \mu \neq 0 \end{aligned},$$

are reported for the DJIA in Table 3a.,for the SP 500 index in Table 3b. and for the SP 500 index futures in Table 3c. For the sample period from 1990 through 1999, Monday returns on a close-to-close bases are positive and significantly different from zero at an alpha level of 5% or better for all of the data sets. Monday returns are significantly positive and much larger in absolute magnitude versus the other days of the week for the DJIA, SP 500 index and SP 500 index futures on a close-to-close basis. For example, Monday's mean DJIA return is 4.8 times larger versus all other days – Tuesday through Friday. This holds true for the SP 500 index and SP 500 futures. These results are also consistent for Monday open-to-close (intraday) and open-to-open returns.

For the pre-1974 period, prior research documents that the unusual (negative) returns observed on Monday accrue from Monday's open to Monday's close. Thus,

[38] See Appendix 1 for detailed results of the preliminary analysis.

the Monday effect pre-1974 is a trading period effect. Post-1974 the Monday effect is observed as a weekend effect; that is the negative returns are observed from Friday's close to Monday's open.[39] In contrast, in the 1990's there is a complete reversal in Monday's return pattern. Not only is Monday's mean return large and positive, but also almost the entire anomalous pattern occurs intraday – from Monday's open to Monday's close.[40] Most importantly, the unusually large positive returns on Monday is a complete reversal of the patterns identified by Smirlock and Starks (1985) and French (1980). Looking at Table 3(a) for the DJIA open-to-close (intraday), you will see that not only are the mean returns large and positive, but all of the DJIA returns are occurring on Monday open-to-close or intraday. The mean for all days Monday through Friday on an open-to-close basis is 0.0315 per cent and the mean for Monday alone is 0.1585 percent. In addition, when looking at Tuesday through Friday open-to-close, the mean return is negative when January is removed (-0.0048%). This is important because January is traditionally a month with large cash inflows into mutual funds. Past research has documented the correlation between volume, price changes and the direction of price changes. In general, there is a consensus that more cash flows will lead to higher returns.[41]

Of particular interest are the mean returns for Thursday for the DJIA. In all cases, except close-to-open, mean returns are negative. Thursday has become the new

[39] It is important to note, that the inferences in Smirlock and Starks (1986) and current work refer to trading patterns of high capitalized stocks exclusively. The day-of-the-week trading pattern in small capitalized stocks over time is heavily dependent upon market microstructure issues and much more complex. This paper makes no inferences about the trading patterns of small capitalized stocks.

[40] These observations are based on time-decomposed returns for the DJIA, which is a proxy for large firm returns. Data problems associated with time-decomposed returns for other indices preclude making inferences for small firm returns. Indices that approximate small firm returns include the Value-Line index and the Center for Research in Security Prices (CRSP) equally weighted index.

[41] For example see Karpoff, 1987; Pfleiderer, 1984; Wang, 1994; and Blume, Easley & O'Hara, 1994.

anomaly—a Thursday effect. This emphasises the dynamic nature of the time series pattern of stock prices and returns. Maberly and Pierce (2003) suggest more recent return data show that anomalies are not robust over time and “familiarity with market microstructure issues in research is shown to be just as important as familiarity with esoteric econometric techniques.”

If we decompose Thursday returns into close-to-open and open-to-close, we find that the negative returns on Thursday are being generated intraday. If unexpected negative information released over the Wednesday close to Thursday open period was the driving force behind Thursday’s anomalous returns, then theory would predict that Thursday’s non-trading period return would be negative. Note the returns for Thursday for the DJIA on a close-to-open basis are positive, therefore you can rule out the release of negative information over the non-trading period as the cause. The observation that the trading period returns are negative are consistent with a flow of funds explanation which suggest that the selling pressure that had been observed on Monday’s has been transformed to Thursday. Using the argument of L&M (1990), there should be a change in the buying pressure ratio on Thursday when the odd-lot data is examined. We would expect to find more selling pressure on Thursday.

Exhibit One

Differences Between Means: SP 500 Index

	Monday	Thursday	All Days
Mean (%)	0.1137	-0.0322	0.0557
Standard Deviation	0.98	0.90	0.89
Number of Observations	482	508	2527
t-statistic*	2.44		2.03
p-value	0.015		0.043

* Thursday's mean is compared to Monday's mean and the mean for all days.

Table 3(b) presents the descriptive results for the SP 500 index close-to-close. The results are consistent with those of the DJIA. Monday's mean return is unusually high and positive (0.1137%), while Thursday's mean return is negative (-0.0322%). The hypothesis tested is Thursday's mean return is the same as Monday's mean return and the results are presented in Exhibit one. The hypothesis is rejected at the 5% level (t= 2.44). Likewise, the hypothesis is rejected when comparing Thursday's mean return to the mean return for all days (Monday through Friday) at the 5% level (t=2.03).

Table 3(c) presents the summary statistics for the SP 500 futures. Futures are a discounting instrument. Net cash flow information during the trading day, especially for index funds, would be of value to futures players so the information should show up here first. SP 500 future contracts trade 15 minutes beyond the close of the NYSE (i.e. spot market). Therefore, SP 500 futures trade until 4:15 pm EST. The futures market more readily discounts information than the spot market. Information held by informed investors is likely to impact futures prices first. There is a saying that "the tail wags the dog." The tail being the SP 500 futures and the dog being the SP 500 index. Assume that average selling pressure dominates Thursday trading. Index futures traders will become aware of this phenomenon and adjust prices accordingly.

The SP 500 future returns are time-decomposed into overnight (close-to-open) and trading period (open-to-close) returns. Overnight returns will reflect new information arriving from 4:15pm EST on day t to 9:30am EST on day t+1. Buying or selling pressure will be reflected in trading period returns. SP 500 futures traders will become aware of the negative selling pressure on Thursday and adjust accordingly. In other words, they will discount the information. Therefore, this should exert downward pressure on the Thursday close-to-open index future returns.

The Thursday SP 500 index futures close-to-open mean return is negative at –0.0155%. However, the Thursday DJIA close-to-open mean return is positive at 0.0130%. This suggests that the SP 500 futures are anticipating Thursday's price pattern, and this is consistent with more selling pressure on Thursday.

Table 3a

Summary statistics: Daily percent returns for the DJIA by day of the week

1990-1999	All Days	Monday	Tuesday	Wednesday	Thursday	Friday	Tuesday-Friday
		Day of the Week					
DJIA: Close-to-Close							
Mean (%)	0.0558	0.1556	0.0697	0.0472	-0.0385	0.0497	0.0322
Std. Deviation	0.8900	0.9900	0.8900	0.7700	0.9000	0.8900	0.8643
t-statistic	3.1517 [a]	3.4506 [a]	1.7807	1.3924	-0.9642	1.2524	1.6847
observations	2527	482	517	516	508	503	2045
Without January							
Mean (%)	0.0537	0.1696	0.0572	0.0509	-0.0430	0.0392	0.0263
Std. Deviation	0.8900	1.0100	0.8900	0.7500	0.8800	0.8800	0.8539
t-statistic	2.9043 [a]	3.5343 [a]	1.4022	1.4760	-1.0537	0.9554	1.3333
observations	2317	443	476	473	465	460	1874
Without Pre and Post Holidays							
Mean (%)	0.0536	0.1610	0.0568	0.0511	-0.0432	0.0505	0.0285
Std. Deviation	0.8900	0.9900	0.8500	0.7700	0.9100	0.9000	0.8596
t-statistic	2.9195 [a]	3.4345 [a]	1.4533	1.4825	-1.0433	1.1890	1.4466
observations	2350	446	473	499	483	449	1904
Without January and Pre/Post Holidays							
Mean (%)	0.0539	0.1766	0.0483	0.0532	-0.0482	0.0480	0.0250
Std. Deviation	0.8800	1.0000	0.8500	0.7600	0.8900	0.9000	0.8459
t-statistic	2.8420 [a]	3.5759 [a]	1.1851	1.4964	-1.1386	1.0786	1.2339
observations	2153	410	435	457	442	409	1743

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3a (continued) Summary statistics: Daily percent returns for the DJIA by day of the week							
		Day of the Week					Tuesday-
1990-1999	All Days	Monday	Tuesday	Wednesday	Thursday	Friday	Friday
DJIA: Close-to-Open							
Mean (%)	0.0242	-0.0030	0.0427	0.0112	0.0130	0.0559	0.0306
Std. Deviation	0.4900	0.5500	0.4500	0.4500	0.4800	0.5200	0.4750
t-statistic	2.4827 [b]	-0.1198	2.1575 [b]	0.5654	0.6104	2.4110 [b]	2.9132 [a]
observations	2527	482	517	516	508	503	2045
Without January							
Mean (%)	0.0278	0.0095	0.0428	0.0214	0.0062	0.0583	0.0321
Std. Deviation	0.4800	0.5500	0.4500	0.4200	0.4600	0.5200	0.4625
t-statistic	2.7878 [a]	0.3635	2.0751 [b]	1.1081	0.2906	2.4046 [b]	3.0045 [a]
observations	2317	443	476	473	465	460	1874
Without Pre and Post Holidays							
Mean (%)	0.0226	0.0019	0.0378	0.0127	0.0050	0.0566	0.0274
Std. Deviation	0.4800	0.5300	0.4100	0.4500	0.4900	0.5300	0.4700
t-statistic	2.2824 [b]	0.0757	2.0051 [b]	0.6304	0.2243	2.2629 [b]	2.5438 [b]
observations	2350	446	473	499	483	449	1904
Without January and Pre/Post Holidays							
Mean (%)	0.0276	0.0183	0.0386	0.0229	-0.0036	0.0643	0.0298
Std. Deviation	0.4700	0.5300	0.4100	0.4200	0.4600	0.5300	0.4550
t-statistic	2.7248 [a]	0.6991	1.9636 [b]	1.1656	-0.1645	2.4536 [b]	2.7343 [a]
observations	2153	410	435	457	442	409	1743

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3a (continued)							
Summary statistics: Daily percent returns for the DJIA by day of the week							
		Day of the Week					Tuesday-
1990-1999	All Days	Monday	Tuesday	Wednesday	Thursday	Friday	Friday
DJIA: Open-to-Close							
Mean (%)	0.0315	0.1585	0.0311	0.0360	-0.0515	-0.0062	0.0027
Std. Deviation	0.7937	0.8800	0.8200	0.7300	0.7400	0.7900	0.7700
t-statistic	1.9965 [b]	3.9543 [a]	0.8624	1.1202	-1.5686	-0.1760	0.1586
observations	2527	482	517	516	508	503	2045
Without January							
Mean (%)	0.0259	0.1601	0.0145	0.0295	-0.0492	-0.0191	-0.0058
Std. Deviation	0.7876	0.8900	0.8000	0.7100	0.7300	0.7800	0.7550
t-statistic	1.5846	3.7862 [a]	0.3954	0.9036	-1.4533	-0.5252	-0.3326
observations	2317	443	476	473	465	460	1874
Without Pre and Post Holidays							
Mean (%)	0.0310	0.1590	0.0190	0.0383	-0.0483	-0.0061	0.0011
Std. Deviation	0.7951	0.8800	0.8000	0.7400	0.7400	0.8000	0.7700
t-statistic	1.8934	3.8158 [a]	0.5165	1.1562	-1.4345	-0.1616	0.0623
observations	2351	446	473	499	483	449	1904
Without January and Pre/Post Holidays							
Mean (%)	0.0263	0.1583	0.0097	0.0303	-0.0446	-0.0163	-0.0048
Std. Deviation	0.7885	0.8900	0.7900	0.7200	0.7300	0.8000	0.7600
t-statistic	1.5469	3.6015 [a]	0.2561	0.8996	-1.2845	-0.4121	-0.2637
observations	2154	410	435	457	442	409	1743

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3a
Summary statistics: Daily percent returns for the DJIA by day of the week

1990-1999	All Days		Monday	Tuesday		Wednesday	Thursday	Friday	Tuesday-Friday	
			Day of the Week							
DJIA: Open-to-Open										
Mean (%)	0.0565		-0.0144	0.1876		0.0449	0.0505	0.0073	0.0725	
Std. Deviation	0.9800		1.0513	0.9907		0.9608	0.9195	0.9694	0.9601	
t-statistic	2.8982	a	-0.3001	4.3097	a	1.0604	1.2370	0.1687	3.4172	a
observations	2527		482	518		516	508	503	2045	
Without January										
Mean (%)	0.0558		-0.0121	0.1873		0.0382	0.0442	0.0150	0.0712	
Std. Deviation	0.9704		1.0425	1.0005		0.9275	0.8989	0.9711	0.9495	
t-statistic	2.7679	a	-0.2439	4.0836	a	0.8953	1.0610	0.3307	3.2444	a
observations	2317		443	476		473	465	460	1874	
Without Pre and Post Holidays										
Mean (%)	0.0617		-0.0036	0.1835		0.0520	0.0454	0.0267	0.0769	
Std. Deviation	0.9846		1.0585	0.9853		0.9620	0.9254	0.9883	0.9652	
t-statistic	3.0384	a	-0.0718	4.0507	a	1.2086	1.0777	0.5721	3.4772	a
observations	2351		446	473		499	483	450	1905	
Without January and Pre/Post Holidays										
Mean (%)	0.0607		-0.0004	0.1856		0.0456	0.0340	0.0347	0.0750	
Std. Deviation	0.9739		1.0472	0.9963		0.9267	0.9052	0.9904	0.9546	
t-statistic	2.8905	a	-0.0085	3.8859	a	1.0520	0.7892	0.7085	3.2793	a
observations	2154		410	435		457	442	410	1744	

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3b

Summary statistics: Daily percent returns for the Standard & Poor's 500 Index by day of the week

1990-1999	All Days	Day of the Week: Monday	Tuesday	Wed	Thursday	Friday	Tuesday-Friday
S&P 500: Close to Close							
All Days							
Mean (%)	0.0557	0.1137	0.0637	0.0793	-0.0322	0.0564	0.0520
Std. Deviation	0.8900	0.9800	0.9100	0.7800	0.9000	0.8900	0.8700
t-statistic	3.1461 [a]	2.5472 [b]	1.5916	2.3094 [b]	-0.8064	1.4213	2.7029 [a]
observations	2527	482	517	516	508	503	2045
Without January							
Mean (%)	0.0548	0.1328	0.0512	0.0780	-0.0367	0.0523	0.0364
Std. Deviation	0.8900	1.0000	0.8700	0.7700	0.8900	0.8800	0.8525
t-statistic	2.9638 [a]	2.7951 [a]	1.2840	2.2031 [b]	-0.8892	1.2747	1.8484
observations	2317	443	476	473	465	460	1874
Without Pre and Post Holidays							
Mean (%)	0.0573	0.1221	0.0554	0.0914	-0.0367	0.0584	0.0422
Std. Deviation	0.8800	0.9700	0.8700	0.7600	0.9000	0.8900	0.8550
t-statistic	3.1565 [a]	2.6583 [a]	1.3849	2.6865 [a]	-0.8962	1.3904	2.1537 [b]
observations	2350	446	473	499	483	449	1904
Without January and Pre/Post Holidays							
Mean (%)	0.0589	0.1427	0.0476	0.0884	-0.0428	0.0637	0.0392
Std. Deviation	0.8800	0.9800	0.8800	0.7600	0.8900	0.8900	0.8550
t-statistic	3.1057 [a]	2.9484 [a]	1.1282	2.4865 [b]	-1.0110	1.4475	1.9141
observations	2153	410	435	457	442	409	1743

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3c
Summary statistics: Daily percent returns for the Standard & Poor's 500 Index Futures by day of the week

1990-1999	All Days	Day of the Week: Monday	Tuesday	Wed	Thursday	Friday	Tuesday-Friday
S&P 500 Futures: Close to Close							
All Days							
Mean (%)	0.0436	0.1107	0.0523	0.0644	-0.0413	0.0343	0.0278
Std. Deviation	0.9544	1.0416	0.9819	0.8107	0.9688	0.9581	0.9322
t-statistic	2.2966 [b]	2.3334 [b]	1.2127	1.8055	-0.9617	0.8021	1.3471
observations	2527	482	518	516	508	503	2045
Without January							
Mean (%)	0.0453	0.1288	0.0414	0.0601	-0.0443	0.0325	0.0227
Std. Deviation	0.9544	1.0591	0.9869	0.8074	0.9525	0.9516	0.9271
t-statistic	2.2845 [b]	2.5603 [b]	0.9146	1.6181	-1.0017	0.7318	1.0581
observations	2317	443	476	473	465	460	1874
Without Pre and Post Holidays							
Mean (%)	0.0434	0.1248	0.0407	0.0673	-0.0477	0.0369	0.0244
Std. Deviation	0.9471	1.0286	0.9494	0.8172	0.9728	0.9623	0.9263
t-statistic	2.2213 [b]	2.5615 [b]	0.9317	1.8401	-1.0785	0.8141	1.1474
observations	2350	446	473	499	483	450	1905
Without January and Pre/Post Holidays							
Mean (%)	0.0455	0.1432	0.0352	0.0604	-0.0500	0.0451	0.0225
Std. Deviation	0.9471	1.0432	0.9556	0.8155	0.9543	0.9628	0.9219
t-statistic	2.2292 [b]	2.7797 [a]	0.7681	1.5824	-1.1013	0.9481	1.0205
observations	2154	410	435	457	442	410	1744

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3c (continued)

Summary statistics: Daily percent returns for the Standard & Poor's 500 Index Futures by day of the week

1990-1999	All Days	Day of the Week: Monday	Tuesday	Wed	Thursday	Friday	Tuesday-Friday
S&P 500 Futures: Close to Open (Intraday)							
All Days							
Mean (%)	0.0129	0.0121	0.0252	0.0196	-0.0155	0.0271	0.0131
Std. Deviation	0.4356	0.4590	0.3801	0.3317	0.4757	0.4997	0.4300
t-statistic	1.4934	0.5788	1.5081	1.3453	-0.7333	1.2168	1.3822
observations	2527	482	518	516	508	503	2045
Without January							
Mean (%)	0.0115	0.0202	0.0224	0.0286	-0.0276	0.0229	0.0094
Std. Deviation	0.4306	0.4661	0.3792	0.3500	0.4549	0.5033	0.4219
t-statistic	1.2800	0.9112	1.2859	1.7772	-1.3097	0.9740	0.9633
observations	2317	443	476	473	465	460	1874
Without Pre and Post Holidays							
Mean (%)	0.0105	0.0161	0.0247	0.0137	-0.0230	0.0226	0.0092
Std. Deviation	0.4314	0.4510	0.3564	0.3495	0.4814	0.5030	0.4268
t-statistic	1.1836	0.7535	1.5067	0.8757	-1.0500	0.9547	0.9439
observations	2350	446	473	499	483	450	1905
Without January and Pre/Post Holidays							
Mean (%)	0.0105	0.0260	0.0233	0.0178	-0.0356	0.0227	0.0068
Std. Deviation	0.4260	0.4564	0.3534	0.3312	0.4604	0.5106	0.4186
t-statistic	1.1385	1.1553	1.3770	1.1512	-1.6273	0.8987	0.6772
observations	2154	410	435	457	442	410	1744

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3c continued

Summary statistics: Daily percent returns for the Standard & Poor's 500 Index Futures by day of the week

1990-1999	All Days	Day of the Week: Monday		Tuesday	Wed	Thursday	Friday	Tuesday-Friday
S&P 500 Futures: Open to Close								
All Days								
Mean (%)	0.0306	0.0986		0.0271	0.0490	-0.0259	0.0074	0.0146
Std. Deviation	0.8616	0.9436		0.9194	0.7827	0.8300	0.8272	0.8406
t-statistic	1.7877	2.2942	b	0.6717	1.4221	-0.7033	0.2006	0.7869
observations	2527	482		518	516	508	503	2045
Without January								
Mean (%)	0.0315	0.1087		0.0190	0.0404	-0.0166	0.0096	0.0133
Std. Deviation	0.8600	0.9500		0.9199	0.7750	0.8234	0.8187	0.8358
t-statistic	1.7631	2.4083	b	0.4511	1.1337	-0.4347	0.2515	0.6889
observations	2317	443		476	473	465	460	1874
Without Pre and Post Holidays								
Mean (%)	0.0329	0.1087		0.0160	0.0536	-0.0247	0.0143	0.0151
Std. Deviation	0.8600	0.9323		0.9000	0.7895	0.8272	0.8476	0.8415
t-statistic	1.8545	2.4623	b	0.3859	1.5166	-0.6562	0.3579	0.7832
observations	2350	446		473	499	483	450	1905
Without January and Pre/Post Holidays								
Mean (%)	0.0350	0.1172		0.0119	0.0454	-0.0144	0.0224	0.0157
Std. Deviation	0.8578	0.9379		0.9012	0.7834	0.8224	0.8416	0.8371
t-statistic	1.8937	2.5302	b	0.2754	1.2402	-0.3681	0.5389	0.7832
observations	2154	410		435	457	442	410	1744

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 3c (Continued)

Summary statistics: Daily percent returns for the Standard & Poor's 500 Index Futures by day of the week

1990-1999	All Days	Monday	Tuesday	Wed	Thursday	Friday	Tuesday-Friday
		Day of the Week					
S&P 500 Futures: Open to Open							
All Days							
Mean (%)	0.0443	0.0203	0.1143	0.0394	0.0355	0.0034	0.0500
Std. Deviation	0.9872	1.0011	0.9866	0.9672	0.9634	0.9967	0.9840
t-statistic	2.2574 [b]	0.4452	2.6348 [a]	0.9256	0.8296	0.0760	2.2978 [b]
observations	2526	482	517	516	508	503	2045
Without January							
Mean (%)	0.0454	0.0334	0.1189	0.0204	0.0226	0.0100	0.0482
Std. Deviation	0.9796	0.9955	0.9904	0.9500	0.9476	0.9980	0.9761
t-statistic	2.2304 [b]	0.7062	2.6193 [a]	0.4670	0.5138	0.2147	2.1382 [b]
observations	2317	443	476	473	465	460	1873
Without Pre and Post Holidays							
Mean (%)	0.0499	0.0297	0.1162	0.0560	0.0294	0.0154	0.0564
Std. Deviation	0.9961	1.0128	0.9903	0.9928	0.9684	1.0194	0.9924
t-statistic	2.4284 [b]	0.6191	2.5514 [b]	1.2600	0.6672	0.3195	2.4777 [b]
observations	2350	446	473	499	483	449	1904
Without January and Pre/Post Holidays							
Mean (%)	0.0455	0.0457	0.1249	0.0501	0.0122	0.0238	0.0530
Std. Deviation	0.9471	1.0044	0.9966	0.9703	0.9520	1.0205	0.9845
t-statistic	2.2291 [b]	0.9207	2.6141 [a]	1.1038	0.2699	0.4724	2.2484
observations	2153	410	435	457	442	409	1743

[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two-tailed test.
The t-statistic is testing the hypothesis that the mean equals zero versus the alternative hypothesis that the mean is different from zero.

Table 4 exhibits the daily mean return ratios for the DJIA, SP 500 index and SP 500 index futures. The daily mean return ratios is defined as Monday's mean return divided by Tuesday through Friday mean return. The results indicate conclusively that Monday's mean return is large relative to other days of the week. The most startling observation is the ratio for the DJIA open-to-close returns. The daily mean return ratio of 58.7 for the DJIA indicates that almost all of the returns accrue during the open to close period on Monday. In particular, the mean DJIA open-to-close return is 0.1585% versus the mean Tuesday through Friday open-to-close return that is 0.0027%. On an accumulative basis Monday's open-to-close return for the DJIA is approximately 94% of the total return accruing over the trading period. Tuesday through Friday trading contributes less than 5% to the overall return yet it represents 80% of the trading time. The decade of the 1990's represents one of the longest bull market trading periods in the market's history and the contribution to this bull market is dominated by Monday returns. This result has not been recognized in the literature.

Table 4

Daily Mean Return Ratio:

1990 through 1999*

Monday vs. Tuesday - Friday

	Ratios	
	Close-to-Close	**Open-to-Close**
DJIA	4.80	58.70
SP 500 Spot	2.18	NA
SP 500 Futues	3.98	6.75

*Ratio = Monday mean return/Tuesday-Friday mean return

Table 5

Comparative summary statistics for daily percent returns by study, sample period and day of the week

Time Period		All Days	Monday	Tuesday	Wednesday	Thrusday	Friday
Standard & Poors 500: Close-to-Close							
1953-1977	Mean	0.0153	-0.1681	0.0157	0.0967	0.0448	0.0873
French	Std. Dev.	0.7327	0.8427	0.7267	0.7483	0.6857	0.6600
	t-statistic	1.6186	-6.8230 [a]	0.7460	4.5340 [a]	2.2830 [b]	4.5990 [a]
	observations	6024	1170	1193	1231	1221	1209
1990-1999	Mean	0.0557	11.3730	13.0585	7.9341	-0.0322	0.0564
Pierce	Std. Dev.	0.8920	0.9779	1.7264	0.7772	0.8973	0.8884
	t-statistic	3.1386 [a]	255.3367 [b]	171.9916	231.8853 [b]	-0.8088	1.4238
	observations	2527	482	517	516	508	503
Dow Jones Inditrial Average: Close-to-Close							
1963-1983	Mean	0.0106	-0.1108	-0.0050	0.0759	0.0230	0.0636
Smirlock & Starks	Std. Dev.	0.8440	0.9650	0.8548	0.9266	0.8169	0.7840
	t-statistic	0.8700	-3.4600 [a]	-0.1800	2.5800 [a]	0.8800	2.5200 [b]
	observations	4799	908	947	992	977	965
1990-1999	Mean	0.0558	0.1556	0.0697	0.0472	-0.0385	0.0497
Pierce	Std. Dev.	0.8900	0.9900	0.8900	0.7700	0.9000	0.8900
	t-statistic	3.1517 [a]	3.4506 [a]	1.7807	1.3924	-0.9642	1.2524
	observations	2527	482	517	516	508	503
Dow Jones Industrial Average: Close-to-Open							
1963-1983	Mean	0.0034	-0.0386	-0.0088	0.0002	0.0419	0.0196
Smirlock & Starks	Std. Dev.	0.4282	0.4754	0.4103	0.3150	0.3875	0.3805
	t-statistic	0.5500	-2.4600 [b]	-0.6600	0.0200	3.3800 [a]	1.6000
	observations	4799	918	947	992	977	965
1990-1999	Mean	0.0242	-0.0030	0.0427	0.0112	0.0130	0.0559
Pierce	Std. Dev.	0.4900	0.5500	0.4500	0.4500	0.4800	0.5200
	t-statistic	2.4974 [b]	-0.1198	2.1575 [b]	0.5654	0.6104	2.4110 [b]
	observations	2557	482	517	516	508	503
Dow Jones Industrial Average: Open-to-Close							
1963-1983	Mean	0.0072	-0.0739	0.0038	0.0756	-0.0187	0.0440
Smirlock & Starks	Std. Dev.	0.7444	0.8054	0.7796	1.0132	0.6423	0.6571
	t-statistic	0.6700	-2.7800 [a]	0.1500	2.3500	-0.9100	2.0800 [b]
	observations	4799	918	947	992	977	965
1990-1999	Mean	0.0324	0.1585	0.0311	0.0360	-0.0515	-0.0062
Pierce	Std. Dev.	0.7900	0.8800	0.8200	0.7300	0.7400	0.7900
	t-statistic	2.0739 [b]	3.9543 [a]	0.8624	1.1202	-1.5686	-0.1760
	observations	2557	482	517	516	508	503

[a] Significant at the one percent level for a two-tailed test,
[b] Significant at the five percent level for a two-tailed test.
[c] Results for French and Smirlock and Starks are original results reported in published papers.

To fully show a reversal of fortunes for Monday, Table 5 compares the original results from French (1980) for the SP 500 Index close-to-close from 1953-1977 data, Smirlock & Starks' (1986) work on the DJIA close-to-close from 1963 to 1983 with the descriptive results of the data in this paper from 1990 to 1999. In every case, the average return for Monday has reversed from significantly negative to significantly positive on a close-to-close basis. In particular, French (1980) reports that Monday's mean return is –0.1681% for the SP 500 index over the 1953-1977 period. Thursday returns were positive at 0.0448%. Furthermore Smirlock & Starks (1986) report a tendency for Monday's return to become less negative over time. Over the sub-period 1963-1968 Monday's return is –0.1549% and during the 1974-1983 sub-period –0.0153%. For the entire period, Monday's returns are –0.1108% for the DJIA and Thursday's return is positive at 0.0230%. These results are significantly different from those reported for the decade of the 1990's.

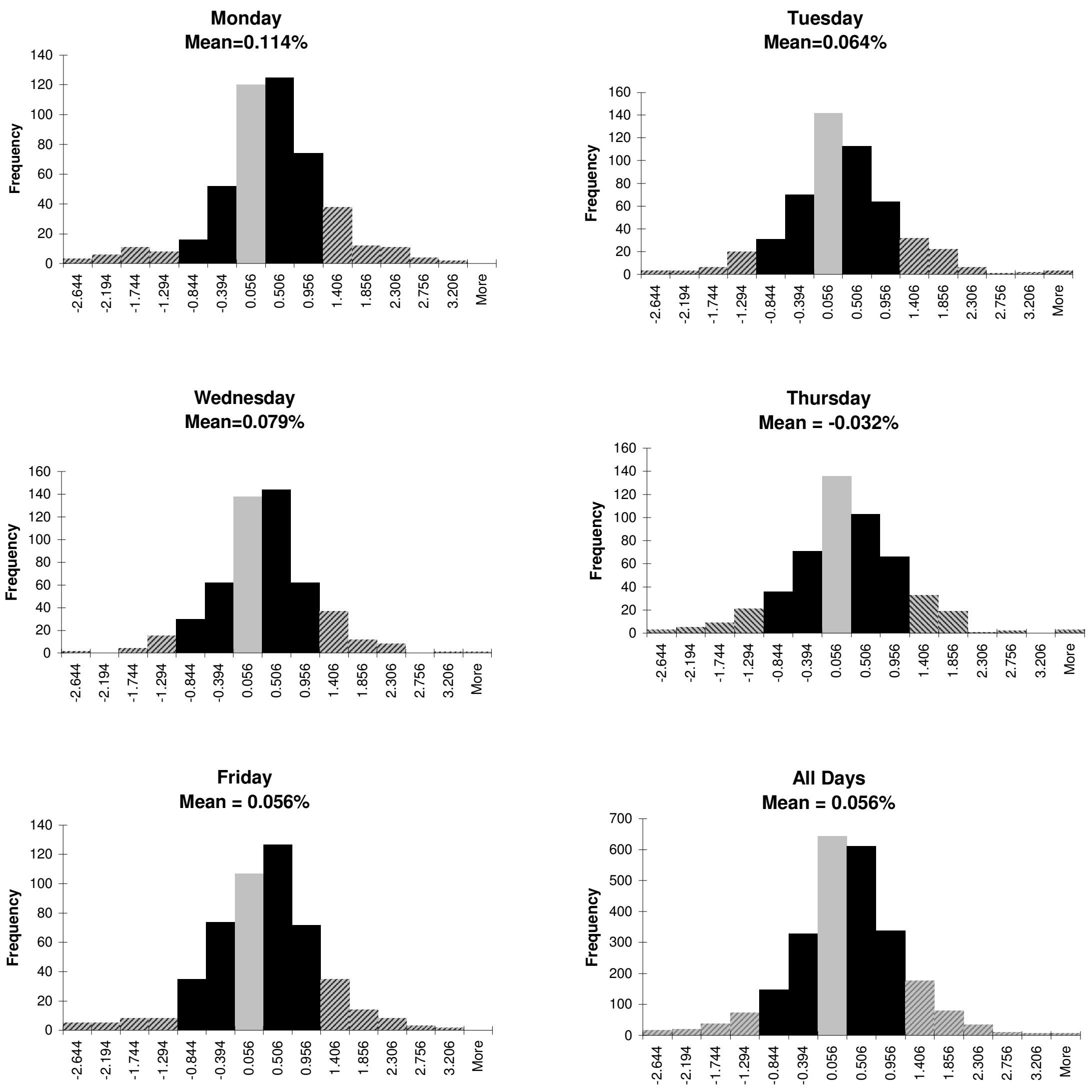


Figure 5: Histograms of daily returns in the S&P 500, in percent, from 1990-1999. Based on the distribution for all days with: μ = 0.0557 and σ =0.89.

The difference between the returns for Monday and the returns for the other days of the week is visually presented by the histograms of these returns in Figure 5. In French's (1980) work, Monday returns over the full period were mostly in the negative region and other days were centered in the positive region. As can be see here, Monday returns over the period are predominately in the positive region with Tuesday, Wednesday and Friday continuing to remain in the positive region. Thursday has become slightly negative.

To further expose the change in fortunes for Monday and the returns for the other days of the week, Table 6 shows the yearly mean return for each day of the week from 1953 to 1999. Between 1953 and 1989, twenty-nine of the 37 years had a negative mean return for Monday so the observed frequency of negative Monday mean returns is 0.7838. In addition, Monday's mean was lower than the mean for any other day of the week 28 of the 37 years. Since 1990, nine out of ten years have shown a positive Monday return so the observed frequency of negative Monday mean returns is 0.100.

Table 6

Standard & Poors 500 Index: Close-to-Close

Average Percent Return

Year	Monday	Tuesday	Wednesday	Thrusday	Friday
1953	-0.2488	-0.0570	0.1181	0.0641	0.0110
1954	0.0362	0.0260	0.1746	0.1959	0.2524
1955	-0.2351	0.0857	0.2497	0.0020	0.3135
1956	-0.1445	-0.0393	-0.0649	0.0327	0.2069
1957	-0.5102	-0.0560	0.3083	-0.0237	-0.0949
1958	0.0301	0.0830	0.1166	0.1246	0.2043
1959	-0.1403	0.0865	0.0066	0.0485	0.1819
1960	-0.3487	0.0121	0.0286	0.0560	0.1604
1961	-0.0620	0.0440	0.2011	0.0631	0.1311
1962	-0.3263	0.0388	0.0404	0.0343	-0.1070
1963	-0.0836	0.1248	0.0525	0.0588	0.0969
1964	-0.0400	-0.0463	0.1023	0.0585	0.1692
1965	-0.1286	0.0505	0.0740	0.0354	0.1512
1966	-0.2645	-0.0414	0.1416	-0.1049	-0.0064
1967	-0.1755	0.1062	0.1343	0.2142	0.1026
1968	0.0007	0.0623	0.2410	-0.0664	0.0086
1969	-0.3503	-0.0691	0.0754	0.0404	0.0842
1970	-0.2790	-0.1230	0.2677	-0.0361	0.1370
1971	-0.0621	0.0872	0.0489	-0.0193	0.0899
1972	-0.1529	0.0206	0.1469	0.0501	0.1935
1973	-0.4738	0.0338	-0.0578	0.1293	-0.0877
1974	-0.3784	0.1677	-0.1015	-0.0956	-0.2676
1975	0.1918	-0.2279	0.1450	0.2250	0.2383
1976	0.1089	0.1496	0.1483	-0.0433	-0.0275
1977	-0.1274	-0.1126	-0.1091	0.0237	0.0403
1978	-0.0994	-0.1225	0.1708	-0.0910	0.1516
1979	-0.0466	0.0362	-0.0282	0.1927	0.0716
1980	-0.2168	0.3474	0.4158	-0.2308	0.1067
1981	-0.1722	-0.0663	-0.0085	0.0007	0.0420
1982	-0.0645	0.1046	0.0646	0.0374	0.1231
1983	-0.0061	-0.0925	0.2348	0.1267	0.0461
1984	-0.1005	0.0951	-0.1435	0.1547	0.0175
1985	0.0673	0.0947	0.0668	0.0909	0.1440
1986	-0.0966	0.0563	0.1607	0.0247	0.1172
1987	-0.6978	0.1640	0.4704	0.1270	-0.0584
1988	0.0854	0.2294	-0.0367	-0.1623	0.1083
1989	0.0302	0.0424	0.1817	0.0559	0.1612
1990	0.1314	-0.0321	0.0049	-0.2971	0.0300
1991	0.0979	0.0848	0.1196	0.2022	-0.0479
1992	0.1633	-0.0631	0.0314	0.0541	-0.0978
1993	0.2095	-0.0601	0.1083	-0.0121	-0.1026
1994	0.0139	-0.0102	0.0482	-0.0567	-0.0257
1995	0.1007	0.1392	0.1245	0.1047	0.1118
1996	0.1254	-0.0037	0.0489	0.0758	0.1219
1997	0.1754	0.5830	-0.0940	-0.2043	0.0640
1998	-0.0016	0.3000	0.1873	-0.2771	0.2552
1999	0.1167	-0.3646	0.2667	0.0901	0.2574

The significance of the change in Monday's return pattern is demonstrated in Table 7 using Bayesian methods. Bayesian methods examine the probability of a model given the data or the idea of subjective probability. The analysis is based on Bayes' Theorem, which can be stated as follows:

> *If $B_1, B_2, \ldots, B_n$ is a set of mutually exclusive events of which one must occur and none has a zero probability, then for any event A for which $P(A) \neq 0$*

$$P(B_r|A) = \frac{P(B_r) \cdot P(A|B_r)}{\sum_{i=1}^{n} P(B_i) \cdot P(A|B_i)}$$

for r = 1,2,..., or n.

In other words, what is the probability of observing *A* (frequency of negative returns for the decade of the nineties for each day of the week) given the prior information *B* (frequency of negative returns for the period 1953-1989 for each day of the week). Bayesian statistics allow us to assess the probability of almost any chosen event (not just those generated by random processes). Using the Bayesian estimate, the prior distribution for negative returns on Monday has a binomial probability of 0.7838. Conditional on the prior distribution the probability of observing one success in ten over the decade of the 1990's is 0.000008, which is zero for all practical purposes. The observed frequency of negative Monday's is below the expected frequency of negative Mondays. The results for Tuesday, Thursday and Friday indicate the observed frequency for negative returns is greater than the expected frequency and the difference is significant. Wednesday yields no significant differences.

Table 7
Bayesian Estimation: Probability of Negative Mean Returns

	Monday	Tuesday	Wednesday	Thursday	Friday
Total number of years with negative returns (N=47): 1953-1999	30	18	9	15	11
Total number of years with negative returns (N=37): 1953-1989	29	12	8	10	7
Total number of years with negative returns (N=10): 1990-1999	1	6	1	5	4
Observed Frequency of Yearly Return being Negative (N=37): 1953-1989	0.7838	0.3243	0.2162	0.2703	0.1892
Expected number based on prior : N=10	7.8378	3.2432	2.1622	2.7027	1.8919
Observed Frequency of Yearly Return being Negative (N=10): 1990-1999	0.1000	0.6000	0.1000	0.5000	0.4000
Probability of getting frequency of observed success over the decade of the 90's conditional on the observed frequency of success over 1953-1989.*	0.0000	0.9832	0.7102	0.9970	0.9740

* This is the probability of observing A or less negative years conditional on the prior. Where A is the observed frequency in row 3. Therefore, the probability of observing A or more negative years conditional on the prior is 1 minus the probability in row 7.

Figure 6
Cumulative Frequency Distribution
of Negative Returns
Standard & Poors 500 Index: Close-to-Close Returns
1953-1999

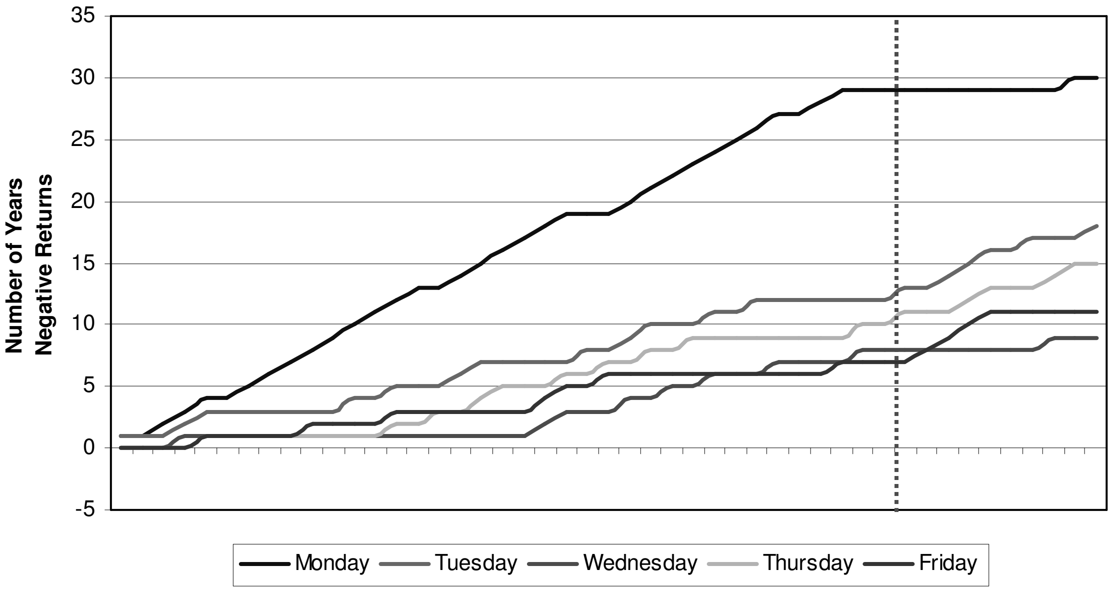
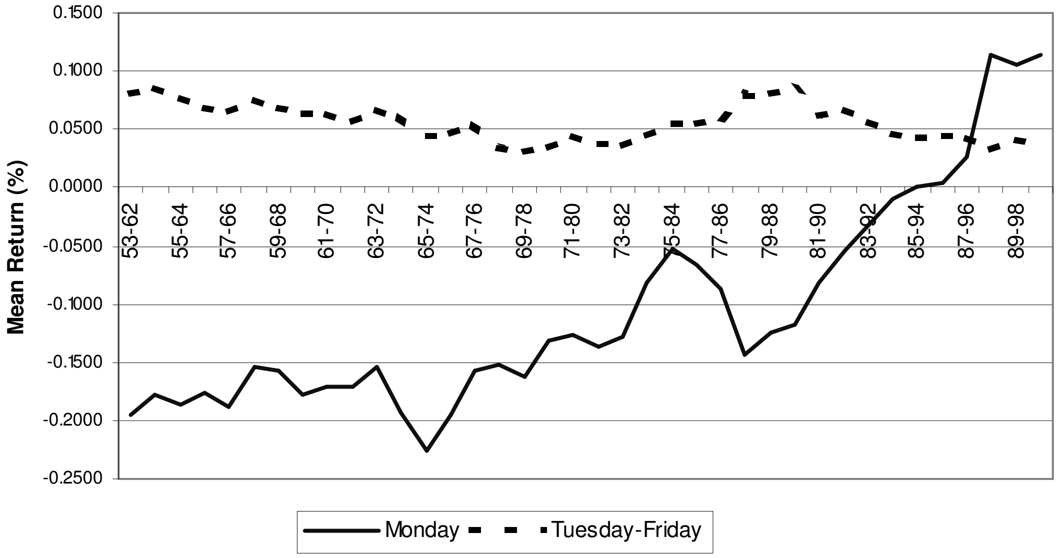


Figure 6 graphically confirms the evidence in Table 7 using cumulative totals. The graph for Monday is monotonically increasing but becomes horizontal after 1987. This is consistent with a structural break in the data.

In order to look for patterns and trends in the data, a 10-year moving average of the mean daily returns were determined and graphed in Figure 7.

Figure 7
Ten Year Moving Average
S&P 500 Index: 1953-1999
Monday vs. Tuesday-Friday



The 10-year moving average of Tuesday through Friday mean returns resembles a time series that is stationary. The deviations about the global mean are small which indicates that there is not much variation in mean returns Tuesday through Friday over the past 47 years. In contrast, the 10-year moving average of Monday mean returns resembles a time series that is non-stationary and deviations about the global mean are large. These results support the conjecture that there has been a significant structural change in the process generating Monday returns. In addition, the 10-year moving average of Monday's mean return is compared to the total net assets in mutual funds. The results are presented in Figure 8.

Figure 8
Monday 10 Year Moving Average
vs.
Total Net Assets Mutual Funds
1953-1999

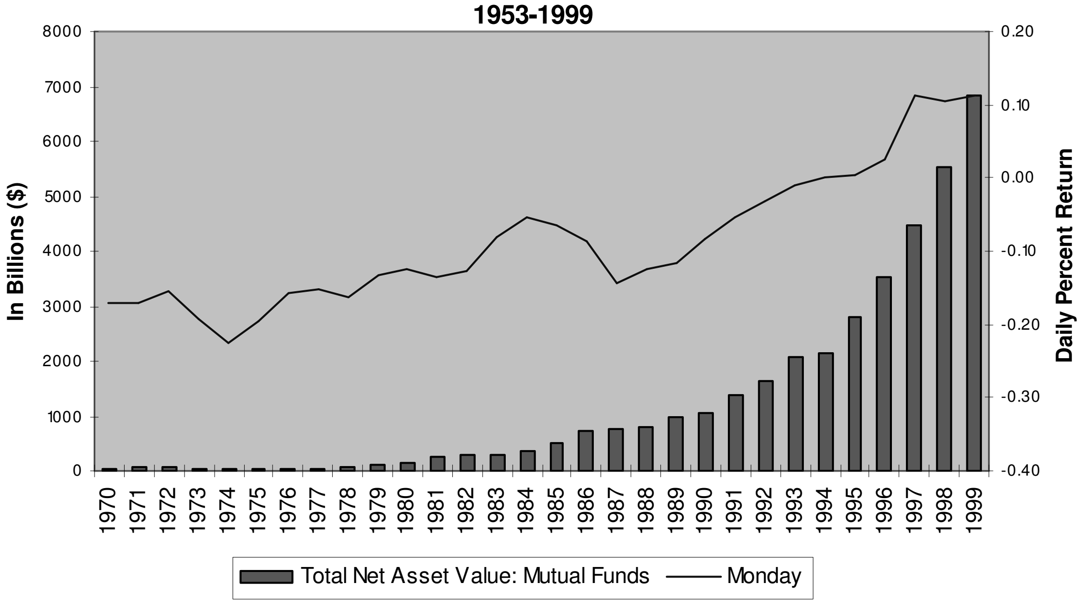
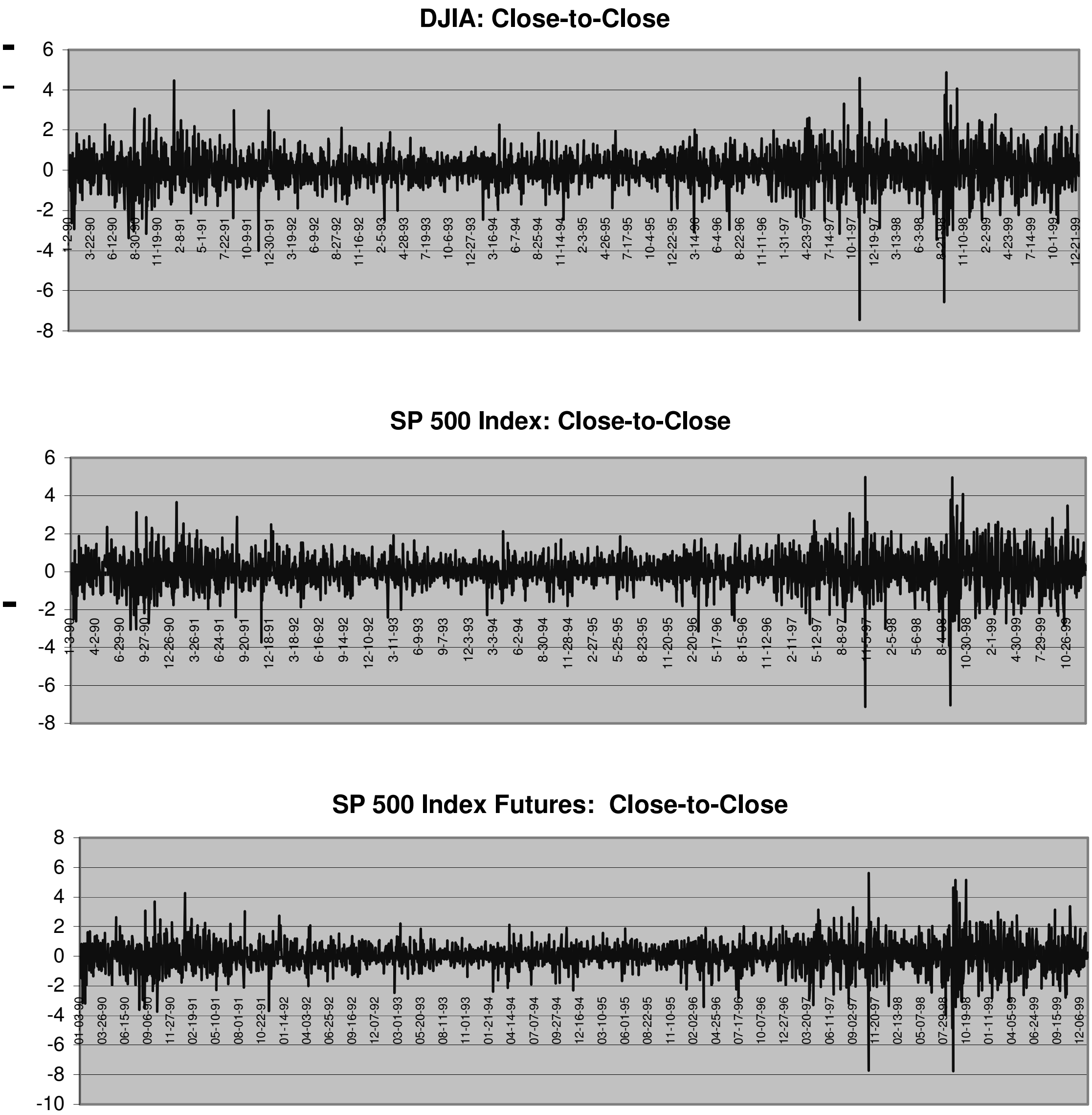


Figure 9 shows the plot of the return series for the DJIA, SP 500 index and SP 500 index futures close-to-close from 1990 to 1999. It is apparent on all of the return series that there is volatility clustering. Both clustering based on anticipated and unanticipated events is present. The volatility clustering implies there is strong autocorrelation. Outliers are also evident in the figures, so it will be important to either remove or "dummy out" the extreme values from the data used to estimate the GARCH model parameters. Extreme values can give inaccurate readings of the autocorrelation statistics. Extreme values can give an appearance of low autocorrelation in squared returns and when removed, volatility clustering becomes apparent.

Figure 9: The time series of the returns on DJIA, S&P 500 Index and S&P 500 Index Futures
Close-to-Close



Trend and Stationarity

Using the Phillips-Perron unit root test, the null hypothesis that the return series has a unit root can be rejected for DJIA, SP 500 index and SP 500 index futures with a probability of 0.0001 for each. Therefore, the return series are stationary. These results are consistent with past research that financial market return data have stochastic rather than deterministic trends.[42] A stationery process can never drift too far from its mean because of finite variance or mean reversion.

Table 8
Test of Autocorrelations in the Daily Returns (R_t) and Squared Daily Returns(R_t^2)

DJIA, SP 500 Index & SP 500 Index Futures
1990-1999

	R_t			R_t^2		
ρ_t	DJIA	SP 500 Index	SP 500 Index Futures	DJIA	SP 500 Index	SP 500 Index Futures
ρ_1	0.03	0.01	-0.04	0.21 [a]	0.22 [a]	0.25 [a]
ρ_2	-0.02	-0.01	-0.03	0.15 [a]	0.14 [a]	0.15 [a]
ρ_3	-0.04	-0.05	-0.03	0.07 [a]	0.08 [a]	0.11 [a]
ρ_4	-0.01	0.00	-0.02	0.10 [a]	0.11 [a]	0.12 [a]
ρ_5	-0.02	-0.04 [b]	-0.03	0.18 [a]	0.19 [a]	0.16 [a]

Note: ρ_t is the autocorrelation coefficient at lag *t*. LBQ statistic tests the null hypothesis that autocorrelations for all lags up to lag t=5 equal zero. The LBQ statistics follow a Chisquare distribution with t degrees of freedom.

[a] Signficant at the 1% level

[b] Significant at the 5% level

Table 9 presents a test of autocorrelations for all daily returns and daily squared returns. The *Ljung-Box Q* (LBQ) is used to test the null hypothesis that autocorrelations for all lags up to lag t=5 equal zero. The results show significant autocorrelation in all of the squared returns. The autocorrelations in squared returns

[42] For example see Alexander & Rendell (1995) and Cochrane (1991).

can be captured by the GARCH model. There is no problem with autocorrelation in daily returns with the exception of the SP 500 index at lag 5. Daily returns are stationary and have very little autocorrelation, so they usually are rapidly mean reverting.

Models

The general description of the data clearly shows high returns for Monday relative to other days of the week.

Day-of-the-Week Models

Table 9 presents the results of the of the day-of-the-week model for the DJIA, SP 500 index and SP 500 index futures.[43] The model is represented by the equation:

$$R_t = \beta_0 + \beta_1 Tu_t + \beta_2 W_t + \beta_3 Th_t + \beta_4 F_t + \varepsilon_t ,$$

where β_0 represents the mean return for Monday and $\beta_0+\beta_1$ represents the mean return for Tuesday. Therefore, β_1 represents the difference between the mean return on Monday and the mean return of Tuesday. A significant β_1 indicates the difference between the two days is significant while the sign of β_1 indicates the direction of the difference. In particular a negative β_1 indicates that Tuesday's mean return is less than Monday's mean return in magnitude.

Panel one describes the DJIA. The close-to-close results indicate no difference between Monday and Tuesday mean returns, moderate significance for Wednesday and Friday mean returns, and a highly significant difference between Monday and Thursday mean returns. On a close-to-open or overnight basis Monday is not significantly different from zero and the data exhibits no significant differences with the exception of Friday, which is moderately significant at the 10% level. This

[43] For a complete look at the results for the regression analysis, see Appendix 2.

confirms that the differences are not explained by a closed-market effect. The results also imply the differences are not due to the release of new, unexpected information over the non-trading period. On an open-to-close, intraday, basis all days exhibit highly significant differences at the 1% level for β_1, β_3, and β_4 and at the 5% level for β_2. The sign of the coefficients are negative for β_1, β_3, and β_4. This implies Monday's mean return is greater than the mean returns across all other days of the week and differences are significant. Thursday is of special interest followed by Friday and mean intraday return are both negative. The intraday results are consistent with the anomaly being a day-of-the-week effect and not a weekend effect. When the January effect and holidays are included in the analysis, there appears to be no interaction and results change only slightly.

TABLE 9
Day-of-the-Week Model

$$R_t = \beta_0 + \beta_1 Tu_t + \beta_2 W_t + \beta_3 Th_t + \beta_4 F_t + \varepsilon_t$$

Panel One
Dow Jones Industrial Average
1990-1999

	β_0	β_1	β_2	β_3	β_4	β_5	β_6
Close-to-Close							
With all Days							
Coefficient	0.1556	-0.0859	-0.1083	-0.1940	-0.1059	NA	NA
Standard Error	0.0405	0.0563	0.0563	0.0564	0.0567	NA	NA
t-Statistic	3.8410	-1.5262	-1.9236	-3.4318	-1.8685	NA	NA
P-Value	0.0001	0.1271	0.0545	0.0006	0.0618	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	0.1518	-0.0862	-0.1075	-0.1935	-0.1067	0.0256	0.0228
Standard Error	0.0412	0.0563	0.0564	0.0566	0.0567	0.0641	0.0699
t-Statistic	3.6856	-1.5306	-1.9045	-3.4203	-1.8809	0.3997	0.3271
P-Value	0.0002	0.0002	0.0570	0.0006	0.0601	0.6896	0.7436
Close-to-Open							
With all Days							
Coefficient	-0.0030	0.0457	0.0142	0.0160	0.0589	NA	NA
Standard Error	0.0222	0.0309	0.0309	0.0310	0.0311	NA	NA
t-Statistic	-0.1331	1.4792	0.4576	0.5149	1.8916	NA	NA
P-Value	0.8941	0.1392	0.6473	0.6067	0.0587	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	-0.0008	0.0455	0.0150	0.0166	0.0585	-0.0430	0.0175
Standard Error	0.0226	0.0309	0.0310	0.0311	0.0311	0.0352	0.0384
t-Statistic	-0.0349	1.4723	0.4839	0.5341	1.8791	-1.2224	0.4569
P-Value	0.9722	0.1411	0.6285	0.5933	0.0603	0.2217	0.6478
Open-to-Close (Intraday)							
With all Days							
Coefficient	0.1585	-0.1316	-0.1225	-0.2100	-0.1648	NA	NA
Standard Error	0.0360	0.0501	0.0501	0.0503	0.0504	NA	NA
t-Statistic	4.3984	-2.2628	-2.4439	-4.1740	-3.2666	NA	NA
P-Value	0.0000	0.0087	0.0146	0.0000	0.0011	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	0.1526	-0.1317	-0.1224	-0.2101	-0.1652	0.0686	0.0053
Standard Error	0.0366	0.0501	0.0502	0.0503	0.0505	0.0570	0.0622
t-Statistic	4.1640	-2.6286	-2.4392	-4.1739	-3.2734	1.2034	0.0858
P-Value	0.0000	0.0086	0.0148	0.0000	0.0011	0.2289	0.9316
Open-to-Open							
With all Days							
Coefficient	0.1973	-0.1557	-0.1476	-0.1946	-0.1994	NA	NA
Standard Error	0.0446	0.0619	0.0620	0.0622	0.0624	NA	NA
t-Statistic	4.4277	-2.5164	-2.3817	-3.1276	-3.1961	NA	NA
P-Value	0.0000	0.0119	0.0173	0.0018	0.0014	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	0.1949	-0.1556	-0.1485	-0.1952	-0.1999	0.0472	0.0186
Standard Error	0.0453	0.0619	0.0621	0.0623	0.0625	0.0704	0.0767
t-Statistic	4.3016	-2.5125	-2.3921	-3.1356	-3.1872	0.6703	-0.2426
P-Value	0.0000	0.0120	0.0168	0.0017	0.0015	0.5027	0.8084

Panel Two SP 500 Index 1990-1999							
	β_0	β_1	β_2	β_3	β_4	β_5	β_6
Close-to-Close							
With all Days							
Coefficient	0.1137	-0.0500	-0.0340	-0.1460	-0.0570	NA	NA
Standard Error	0.0406	0.0564	0.0565	0.0567	0.0568	NA	NA
t-Statistic	2.8012	-0.8874	-0.0609	-2.5750	-1.0096	NA	NA
P-Value	0.0051	0.3749	0.5425	0.0101	0.3128	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	0.1106	-0.0508	-0.0345	-0.1453	-0.0570	0.0261	0.0132
Standard Error	0.0413	0.0567	0.0565	0.0568	0.0569	0.0641	0.0705
t-Statistic	2.6805	-0.8974	-0.6114	-2.5570	-1.0020	0.4066	0.1872
P-Value	0.0074	0.3696	0.5410	0.0106	0.3164	0.1872	0.8515

The t-statistic is testing the null hypothesis that the coefficient equals zero versus the alternative that the coefficient is different from zero.

Panel two presents the results for the SP 500 index. Once again, Monday's mean return is significantly different from zero and positive. The only day to exhibit significant differences from Monday is Thursday. However, the coefficients β_1 through β_4 are all negative. This implies Monday's mean return is greater than the mean returns across all other days of the week. There is a limitation with the SP 500 index as only close-to-close results can be calculated. For this reason, the SP 500 index futures are used to calculate time-decomposed returns and the results are presented in panel three. Once again, incorporating effects from holidays and January do not appear to have any strong interaction effects on the mean returns.

SP 500 index futures returns only show a significant difference between Thursday's and Monday's mean return on a open-to-close and close-to-close basis. The sign of the β_1 through β_4 coefficients for close-to-close and open-to-close are negative. However, the coefficients for close-to-open are positive. This supports the view the differences are occurring intraday on Monday and not over the weekend. The coefficient for β_0 close-to-open is positive at 0.0121 while the same coefficient for the DJIA is negative. This is consistent with the futures anticipating the positive returns on Monday intraday.

Panel Three S&P 500 Index Futures 1990-1999							
	β_0	β_1	β_2	β_3	β_4	β_5	β_6
Close-to-Close							
With all Days							
Coefficient	0.1107	-0.0584	-0.0463	-0.1520	-0.0761	NA	NA
Standard Error	0.0434	0.0604	0.0604	0.0607	0.0608	NA	NA
t-Statistic	2.5481	-0.9671	-0.7655	-2.5068	-1.2931	NA	NA
P-Value	0.0109	0.3336	0.4440	0.0122	0.2111	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	0.1101	-0.0584	-0.0463	-0.1521	-0.0761	0.0084	-0.0680
Standard Error	0.0442	0.0604	0.0605	0.0607	0.0609	0.0688	0.0750
t-Statistic	2.4916	-0.9665	-0.7650	-2.5054	-1.2498	0.1214	-0.0091
P-Value	0.0128	0.3339	0.4443	0.0123	0.2115	0.9034	0.9927
Close-to-Open							
With all Days							
Coefficient	0.0121	0.0131	0.0033	-0.0276	0.0152	NA	NA
Standard Error	0.0198	0.0276	0.0276	0.0277	0.0278	NA	NA
t-Statistic	0.6099	0.4646	0.1210	-0.9956	0.5469	NA	NA
P-Value	0.5420	0.6351	0.9037	0.3195	0.5845	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	0.0083	0.0127	0.0046	-0.0268	0.0141	0.0183	0.0314
Standard Error	0.0202	0.0276	0.0276	0.0277	0.0278	0.0314	0.0342
t-Statistic	0.4103	0.4605	0.1666	-0.9686	0.5088	0.5830	0.9166
P-Value	0.6816	0.6452	0.8677	0.3329	0.6110	0.5599	0.3594
Open-to-Close (Intraday)							
With all Days							
Coefficient	0.0986	-0.0715	-0.0496	-0.1245	-0.0912	NA	NA
Standard Error	0.0392	0.0545	0.0546	0.0548	0.0549	NA	NA
t-Statistic	2.5134	-1.3111	-0.9090	-2.2726	-1.6620	NA	NA
P-Value	0.0120	0.1899	0.3635	0.0231	0.0966	NA	NA
With January and Pre/Post Holiday Dummies							
Mean (%)	0.1018	-0.0711	-0.0509	-0.1252	-0.0902	-0.0100	-0.0321
Standard Error	0.0399	0.0545	0.0547	0.0548	0.0550	0.0621	0.0677
t-Statistic	2.5519	-1.3033	-0.9315	-2.2848	-1.6414	-0.1603	-0.4736
P-Value	0.0108	0.1926	0.3517	0.0224	0.1008	0.8726	0.6358
Open-to-Open							
With all Days							
Coefficient	0.0203	0.0940	0.0248	0.0151	-0.0170	NA	NA
Standard Error	0.0450	0.0625	0.0625	0.0628	0.0630	NA	NA
t-Statistic	0.4524	1.5042	0.3961	0.2408	-0.2695	NA	NA
P-Value	0.6510	0.1327	0.6920	0.8097	0.7876	NA	NA
With January and Pre/Post Holiday Dummies							
Coefficient	0.0274	0.0950	0.0215	0.0131	-0.0144	-0.0127	-0.0801
Standard Error	0.0547	0.0625	0.0626	0.0628	0.0630	0.0712	0.0776
t-Statistic	0.5984	1.5194	0.3426	0.2089	-0.2290	-0.1787	-1.0330
P-Value	0.5496	0.1288	0.7319	0.8345	0.8189	0.8582	0.3017

The t-statistic is testing the null hypothesis that the coefficient equals zero versus the alternative that the coefficient is different from zero.

Monday Models[44]

The Monday model represents Monday versus all other days of the week combined and is expressed in the following equation:

$$R_t = \beta_0 + \beta_1 D_t + \varepsilon_t ,$$

where D_t is a dummy variable identifying Tuesday through Friday. If the day-of-the-week is Monday then the value is 0 and for all other days the value is 1. The Monday seasonal is represented by β_0. β_0 is the intercept and represents the mean return for Monday, and the other days of the week mean returns are given by $\beta_0+\beta_1$. β_1 represents the difference between Monday and Tuesday through Friday. A significant β_1 coefficient indicates there is a significant difference. The sign of the coefficient reveals the direction of the difference. R_t represents the daily return for day t, and the disturbances are denoted by ε_t. Table 10 displays the results for the DJIA, SP 500 index and SP 500 index futures.

Panel one present the Monday model results for the DJIA. Monday returns are significantly different from zero (p=0.0001) and positive on a close-to-close, open-to-close and open-to-open basis. This signifies buying pressure on Monday due to positive money flows intraday on Monday, but especially money flows into index funds.. The negative coefficient (-0.0030) for Monday close-to-open is consistent with weak selling pressure on Monday's opening and is consistent with prior results that document more selling pressure on Monday. The price elasticity to money flows is not necessarily uniform or symmetric across days of the week, so this could indicate Monday is more sensitive to money flows.[45]

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[44] For a complete discussion of the results for the Monday model see Appendix 3.
[45] For example, Goetzman & Massa (2003).

TABLE 10
Monday Model

$$R_t = \beta_0 + \beta_1 D_t + \varepsilon_t$$

Panel One Dow Jones Industrial Average 1990-1999			Panel Two SP 500 Index 1990-1999			Panel Three SP 500 Index Futures 1990-1999		
	β_0	β_1		β_0	β_1		β_0	β_1
Close-to-Close			***Close-to-Close***			***Close-to-Close***		
Coefficient	0.1556	-0.1233	**Coefficient**	0.1137	-0.0717	**Coefficient**	0.1107	-0.0584
Standard Error	0.0405	0.0450	**Standard Error**	0.0406	0.0452	**Standard Error**	0.0434	0.0604
t-Statistic	3.8410	-2.7388	**t-Statistic**	2.8012	-1.5890	**t-Statistic**	2.5481	-0.9671
P-Value	0.0001	0.0062	**P-Value**	0.0051	0.1123	**P-Value**	0.0109	0.3336
Close-to-Open						***Close-to-Open***		
Coefficient	-0.0030	0.0336				**Coefficient**	0.0121	0.0010
Standard Error	0.0222	0.0247				**Standard Error**	0.0198	0.0221
t-Statistic	-0.1331	1.3590				**t-Statistic**	0.6099	0.0472
P-Value	0.8941	0.1743				**P-Value**	0.5420	0.9624
Open-to-Close (Intraday)						***Open-to-Close (Intraday)***		
Coefficient	0.1585	-0.1569				**Coefficient**	0.0986	-0.0840
Standard Error	0.0360	0.0401				**Standard Error**	0.0392	0.0436
t-Statistic	4.3984	-3.9163				**t-Statistic**	2.5134	-1.9300
P-Value	0.0000	0.0001				**P-Value**	0.0120	0.0542
Open-to-Open						***Open-to-Open***		
Coefficient	0.1973	-0.1741				**Coefficient**	0.0203	0.0297
Standard Error	0.0446	0.0495				**Standard Error**	0.0450	0.0500
t-Statistic	4.4277	-3.5148				**t-Statistic**	0.4524	0.5933
P-Value	0.0000	0.0004				**P-Value**	0.6510	0.5530

The t-statistic is testing the null hypothesis that the coefficient equals zero versus the alternative that the coefficient is different from zero.

Panel two represents the SP 500 index close-to-close. Monday returns are positive and significantly different from zero at the 1% level (p=0.0051). The mean returns for Tuesday through Friday are lower than Mondays, but are not statistically different at a meaningful level. Once again, there is a limitation with the SP 500 index as only close-to-close results can be calculated. For this reason, the SP 500 index futures are used as a proxy for time-decomposed returns in the spot market and the results are presented in panel three.

If you look at the results for SP 500 index futures open-to-close (intraday), the mean ($\beta_0 + \beta_1$) for Tuesday through Friday is close to zero at 0.0146%. Monday's mean is 6.75 times the magnitude of Tuesday through Friday. This indicates that nearly all of the returns in the SP 500 index futures occurred on Monday. The close-to-open coefficient for β_0 (0.0121) reflects the anticipatory nature of futures. The weekend effect for SP 500 index futures is from the close of the spot market at

4:00pm EST on Friday to 9:30am EST on Monday. However, SP 500 index futures contracts trade fifteen minutes beyond the spot market. Part of the weekend effect is potentially captured in the 4:00pm EST to 4:15pm EST Friday futures price. Data limitation prevents knowing the impact of Friday end-of-the-day trading in the SP 500 index futures. Magnitude of the weekend effect in futures is potentially reduced as from 4:15pm on Friday to Monday's opening at 9:30am close-to-open returns are measured.

Univariate ARMA-GARCH Modelling

The *Ljung-Box Q* (LBQ) results show significant autocorrelation in all of the squared returns. The autocorrelations in squared returns can be captured by the GARCH model. GARCH models perform much better in financial markets. Empirical research has shown that the GARCH (1,1) specification to model the variances of the stock returns is sufficient.[46] The model is represented with a mean equation of:

$$R_t = c + \beta_i D_i + \varepsilon ,$$

where c is the constant, β_i are the parameters of the model and D_i represents the day-of-the-week dummy variables, ε is an error term and i= 1to 4.

The conditional variance equation is represented as:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$$

$$\omega>0,\ \alpha,\ \beta\geq 0$$

$$\alpha+\beta<1,$$

where ω is the constant, α is the error coefficient and β is the lag coefficient.

Based on prior research, the default ARMA (1,0) is used as a starting point and is represented as:

$$R_t = c + \gamma R_{t-1} + \varepsilon_t ,$$

where R_t is returns at time t, and R_{t-i} are returns at time t-i, c is the constant, γ is the parameter of the model, and ε_t is the error term.

[46] For example see the work of Bollerslev (1987), Conrad et al. (1991) and Bollerslev et al. (1992).

To allow for the leverage effects that are inherent in stock returns, the exponential GARCH (EGARCH) model was analysed.[47] The EGARCH model is given by:

$$R_t = c + \beta_i D_i + \gamma R_{t-1} + h_t$$

$$h_t \rightarrow EGARCH(1,1)^{48},$$

where the notation is the same as given in the GARCH(1,1) and ARMA(1,0) models.

To insure that a higher order process was not necessary, several combinations of the ARMA (p,q)-GARCH (1,1) model were checked. The best model was determined to be the ARMA (1,0)-GARCH (1,1) when Akaike info criterion and Schwarz statistics were looked at. The results are shown in Table 11. The best model using the Akaike info criterion is the ARMA (1,0)-EGARCH(1,1) model. Using the Schwarz criterion, the ARMA (0,0)-EGARCH(1,1) had the best results. Since the ARMA(1,0) is widely supported in the literature, the ARMA(1,0)-GARCH(1,1) was selected for further analysis. To assess the appropriateness of this model specification for all three indices on a close-to-close, open-to-close and close-to-open basis, the univariate ARMA(1,0)-GARCH(1,1) model is estimated.

Table 11
ARMA Order Selection for the returns

DJIA									
Model	**Garch (1,1)**	**E-Garch (1,1)**							
ARMA Order (AR, MA)	**(1,0)**	**(0,0)**	**(1,0)**	**(1,1)**	**(2,0)**	**(2,1)**	**(2,2)**	**(0,1)**	**(0,2)**
Akaike info	2.4513	2.4309	2.4289	2.4295	2.4292	2.4293	2.4298	2.4292	2.4292
Schwarz	2.4721	2.4517	2.4520	2.4549	2.4546	2.4570	2.4598	2.4523	2.4546

[47] For a complete printout of the ARMA-EGARCH and GARCH models see Appendix 4
[48] To see the complete conditional variance equation for EGARCH see the methodology section p. 54.

Day-of-the-Week Model

The return data used is the same as used in the day-of-the-week linear regression model section of this chapter and presented in the descriptive section of this chapter.[49] The return data are daily returns covering the period January 1990 to December 1999 on a close-to-close, open-to-close, and close-to-open basis.

The estimated models is given by:

$$R_t = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \gamma R_{t-1} + h_t$$
$$h_t \rightarrow EGARCH(1,1)$$

The results of the ARMA (1,0)-EGARCH(1,1) model are presented in Table 12. The table is divided into three sections, the upper part provides the output for the mean equation, the middle part contains the coefficients of the variance equation and the bottom panel presents various test statistics for each series. β_0 represents an estimate of the mean of the distribution from which Monday's returns came from and $\beta_0+\beta_1$ represents the estimate of the mean of the distribution from which Tuesday returns come from. A significant β_1 indicates the difference between the two days is significant while the sign of β_1 indicates the direction of the difference. In particular, a negative β_1 indicates that Tuesday's mean return is less than Monday's mean return in magnitude.

[49] See the summary of the data in Appendix 1.

Table 12
ARMA(1,0)-EGARCH (1,1) Model
Day of the Week Model

$$R_t = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \gamma R_{t-1} + h_t$$
$$h_t \rightarrow EGARCH(1,1)$$

	DJIA			SP 500 Index	SP 500 Index Futures		
Parameters	**Close-to-Close**	**Open-to-Close**	**Close-to-Open**	**Close-to Close**	**Close-to-Close**	**Open-to-Close**	**Close-to-Open**
Mean Equation							
β_0	0.1448 [a]	0.1540 [a]	-0.0206	0.0986 [a]	0.0841 [a]	0.0899 [a]	-0.0231
β_1	-0.1465 [a]	-0.1649 [a]	0.0363	-0.0925 [b]	-0.0905 [b]	-0.1057 [a]	0.0290
β_2	-0.0853	-0.1181 [a]	0.0339	-0.0278	-0.0247	-0.0479	0.0254
β_3	-0.1557 [a]	-0.1913 [a]	0.0705 [a]	-0.0903 [b]	-0.0871 [b]	-0.0937 [b]	0.0319
β_4	-0.1156 [a]	-0.1588 [a]	0.0468 [b]	-0.0721	-0.0810	-0.1092 [a]	0.0089
γ (AR(1))	0.0535 [b]	0.0020	-0.0274	0.0460 [b]	0.0128	0.0040	-0.0124
Varience Equation							
ω	-0.0997 [a]	-0.1178 [a]	-0.0852 [a]	-0.0989 [a]	-0.1064 [a]	-0.0844 [a]	-0.1760 [a]
α	0.1203 [a]	0.1340 [a]	0.0952 [a]	0.1208 [a]	0.1328 [a]	0.1031 [a]	0.2047 [a]
γ	-0.0772 [a]	-0.0669 [a]	-0.0269 [a]	-0.0778 [a]	-0.0961 [a]	-0.0719 [a]	-0.0614 [a]
β	0.9784 [a]	0.9732 [a]	0.9874 [a]	0.9830 [a]	0.9803 [a]	0.9858 [a]	0.9831 [a]
Residual Analysis							
Akaike info crterion	2.4289	2.2297	1.2104	2.3871	2.4962	2.3192	0.7887
Log Likelihood	-3057.7620	-2806.0730	-1518.7830	-3004.8450	-3142.6560	-2919.1790	-986.1493
Jarque-Bera[c]	518.04 [a]	725.66 [a]	16408.83 [a]	507.4103 [a]	578.9648 [a]	716.7046 [a]	3327.0170 [a]
Skewness	-0.3769	-0.4399	-0.9949	-0.3844	-0.4096	-0.4363	-0.7088
Kurtosis	5.0865	5.4739	15.3265	5.0567	5.1977	5.4593	8.4407
Engle's LM Test[d]	0.4010	18.7754	4.1961	5.2725	6.0298	13.6098	10.0889
ARCH LM F-Statistic[e]	5.6345	1.1743	0.2984	0.3751	0.4292	13.6098	0.7192

[a] Significant at the one percent level.
[b] Significant at the five percent level.
[c] Jarque-Bera statistic tests whether the seies is normally distributed.
[d] Engle's LM tests the null hypothesis that there is no ARCH up to order q in the residuals
[e] The F-statistic is an omitted variable test for the joint significance of all lagged squared residuals.
Note: Individual standard errors and t-statistics can be found in Appendix 4.

The Engle's LM test statistics tests the null hypothesis that there is no ARCH up to order q in the residuals. In addition, the ARCH LM F-statistic is an omitted variable test for the joint significance of all lagged squared residuals. There is no evidence in the DJIA, SP 500 index or SP 500 index futures of additional ARCH affects on a close-to-close, open-to-close or close-to-open basis.

To look at the distribution of the series; skewness, kurtosis and the Jarque-Bera statistic is reported. Skewness is a measure of asymmetry of the distribution around the mean. All series had a negative skew, which implies all series have a long left tail. Kurtosis measures whether the distribution of the series is leptokurtic (peaked) or platykurtic (flat). The kurtosis greatly exceeds 3 for all series distributions indicating the series are highly leptokurtic relative to the normal distribution. The Jarque-Bera statistics test whether the series is normally distributed. The statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The statistic is highly significant at the one percent level for all day-of-the-week series, so we can reject the hypothesis the series are normally distributed.

The γ's in the variance equation is negative and significant for all series. The negative coefficient indicates the series all have leverage effects and EGARCH is the appropriate model. The significant results for the γ's indicate significant impacts of the time-varying risk on their own returns. This implies that the time-varying risk of all the series is important in explaining its own return.

On a close-to-close basis, DJIA Monday's returns are positive and significantly different from zero at the one percent level. In addition, highly significant differences from Monday's returns are identified for Tuesday, Thursday and Friday. Tuesday through Friday returns have negative coefficients indicating returns of lower magnitude than Monday returns with Tuesday and Thursday returns being negative overall.

On a close-to-open (overnight) basis Monday returns are negative and are not significantly different from zero. Thursday (1% level) and Friday (5% level) exhibit significant differences and all days exhibit higher returns than Monday. This confirms the differences are not explained by a closed-market effect. The results also imply the differences are not due to the release of new, unexpected information over the non-trading period.

On an open-to-close (intraday) basis all days exhibit highly significant differences at the one percent level. The sign of the coefficients are negative implying Monday's mean return is greater than the mean return across all other days of the week and the differences are significant. Tuesday, Thursday and Friday are all negative indicating all of the returns on an intraday basis occurred on Monday and Wednesday during the selected bull market period. The results confirm those found using the ordinary linear regression model and are consistent with the anomaly being a day-of-the-week effect and not a weekend effect.

The results for the SP 500 index close-to-close exhibit similar results for Monday returns. The returns are significantly different from zero and positive. Only Tuesday and Thursday exhibit significant differences at the five percent level from Monday. All of the coefficients have a negative sign indicating returns for all days (Monday through Friday) are a lower magnitude than that of Monday returns.

SP 500 index futures close-to-close show Monday returns are significantly different from zero at the one percent level and positive. The results indicate a significant difference (5% level) between Monday and Tuesday returns and Monday and Thursday returns. The sign of all of the coefficients are negative. The returns are positive for each day except Thursday, which has a slightly negative estimate of the mean returns.

The SP 500 index futures intraday results confirm significant positive results for Monday. Tuesday and Friday exhibit differences at the one percent level and Thursday at the five percent level. Once again, all of the coefficient signs are negative with Tuesday, Thursday and Friday estimates indicating negative returns.

The β_0 coefficient for SP 500 futures close-to-open is negative. This provides weak evidence of the traditional weekend effect. All other coefficients are positive. There are no significant differences.

Monday Model

The Monday model represents Monday versus all other days of the week combined and is represented by:

$$\begin{gathered} R_t = \beta_0 + \beta_1 D_1 + \gamma R_{t-1} + h_t \\ h_t \rightarrow EGARCH(1,1) \end{gathered},$$

β_0 represents the estimate of the mean of the distribution from which Monday's returns come from and the estimate for the other days of the week is given by $\beta_0+\beta_1$. β_1 represents the difference between Monday and Tuesday through Friday. A significant β_1 coefficient indicates there is a significant difference. The sign of the coefficient reveals the direction of the difference. Table 13 displays the results for the DJIA, SP 500 index and SP 500 index futures.

The results for the DJIA indicate Monday returns are significantly different from zero at the one percent level and positive on a close-to-close and open-to-close basis. This is consistent with buying pressure on Monday due to positive money flows intraday on Monday. The negative coefficient for Monday close-to-open is consistent with weak selling pressure on Monday's opening and is consistent with results from the linear regression Monday model that documents more selling pressure and sensitivity to money flows on Monday.

Monday returns for the SP 500 index are positive and significantly different from zero at the one percent level. The estimates for Tuesday through Friday are significantly lower than Mondays at the five percent level.

On a close-to-close and open-to-close basis SP 500 index futures Monday estimates are positive and significantly different from zero at the one percent level. Tuesday through Friday are significantly different from Monday's estimate on a close-to-close basis at the five percent level and open-to-close at the one percent level. As with the linear models, the intraday mean estimate for Tuesday through Friday is close to zero at 0.0013%. Again, this emphasises how little Tuesday through Friday contribute to the total return over the entire period. The total return is predominately due to Monday returns alone. Monday estimated returns are 69 times larger than Tuesday through Friday indicating all of the returns in the SP 500 index futures occurred on Monday.

To insure the mean equation is correctly specified, a correlogram (autocorrelations and partial autocorrelations) of the standardized residuals and standardized residuals squared for 16 lags was generated along with the Partial Autocorrelations (PAC), Ljung-Box *Q*-statistics and their *p*-values for each data set under the assumptions of each model.[50] This is used to test for remaining serial correlation in the mean equation and to check if the mean equation is correctly specified. If correctly specified then the *Q*-Statistics for the standardized residuals should not be significant. In addition, if the pattern is one that can be captured by an

[50] For a complete listing of the Q-statistics for all the models see Appendix 4.

Table 13
ARMA(1,0)-EGARCH (1,1) Model
Monday Model

$$R_t = \beta_0 + \beta_1 D_1 + \gamma R_{t-1} + h_t$$
$$h_t \rightarrow EGARCH(1,1)$$

Parameters	DJIA			SP 500 Index	SP 500 Index Futures		
	Close-to-Close	Open-to-Close	Close-to-Open	Close-to-Close	Close-to-Close	Open-to-Close	Close-to-Open
Mean Equation							
β_0	0.1453 [a]	0.1543 [a]	-0.0206	0.0988 [a]	0.0844 [a]	0.0897 [a]	-0.0235 [b]
β_1	-0.1247 [a]	-0.1594 [a]	0.0434 [b]	-0.0730 [b]	-0.0704 [b]	-0.0884 [a]	0.0251
AR(1)	0.0518 [b]	0.0029	-0.0312	0.0534 [b]	0.0090	0.0038	-0.0094
Varience Equation							
ω	-0.0992 [a]	-0.1197 [a]	-0.0792 [a]	-0.1044 [a]	-0.1082 [a]	-0.0870 [a]	-0.1779 [a]
α	0.1196 [a]	0.1363 [a]	0.0901 [a]	0.1267 [a]	0.1351 [a]	0.1062 [a]	0.2064 [a]
γ	-0.0764 [a]	-0.0674 [a]	-0.0269 [a]	-0.0817 [a]	-0.0958 [a]	-0.0724 [a]	-0.0591 [a]
β	0.9788 [a]	0.9729 [a]	0.9888 [a]	0.9811 [a]	0.9799 [a]	0.9853 [a]	0.9827 [a]
Residual Analysis							
Akaike info crterion	2.4267	2.2235	1.2224	2.3859	2.4950	2.3179	0.7870
Log Likelihood	-3057.8740	-2801.2480	-1536.8940	-3006.3870	-3144.1890	-2920.5000	479.3930
Jarque-Bera[c]	506.70 [a]	702.32 [a]	16105.70 [a]	508.3673 [a]	577.7517 [a]	710.0648 [a]	3461.1130 [a]
Skewness	-0.3750	-0.4228	-1.0649	-0.3905	-0.4145	-0.4363	-0.7329
Kurtosis	5.0620	5.4409	15.1855	5.0543	5.1913	5.4465	8.5440
Engle's LM Test[d]	5.9472	18.6459	4.6096	5.4083	6.3377	13.5344	10.1703
ARCH LM F-Statistic[e]	0.4233	1.3338	0.3279	0.3848	0.4511	0.9662	0.7250

[a] Significant at the one percent level.
[b] Significant at the five percent level.
[c] Jarque-Bera statistic tests whether the seies is normally distributed.
[d] Engle's LM tests the null hypothesis that there is no ARCH up to order q in the residuals
[e] The F-statistic is an omitted variable test for the joint significance of all lagged squared residuals.
Note: Individual standard errors and t-statistics can be found in Appendix 4.

autoregression of order less than k, then the PAC will be close to zero. Table 14 presents the first five lags for each model and data set for discussion.

As can be seen, the mean equation is correctly specified for both the DJIA and SP 500 Index futures for all data sets with Q-statistics being non-significant and PAC is close to zero. The SP 500 Index exhibits additional autocorrelation with significant results at lags 3, 4 and 5. One possible explanation for the difference in the results for the SP 500 index is the stale quote problem discussed earlier that exists for the SP 500 index. SP 500 index returns are not true transaction prices and a true opening price does not exist.[51]

To test for remaining ARCH in the variance equation and to check the specification of the variance equation, the correlogram, PAC, and Q-statistics of the standardized residuals squared were analysed. If the variance equation is correctly specified, all Q-statistics should be insignificant. Table 15 presents the results for the first five lags for discussion.[52]

[51] For additional discussion of the stale quote problem, see footnote 28.
[52] For a complete table of the correlograms, PAC and Q-statistics see Appendix 4.

Table 14
Residual Test: Q-Statistics of Standardized Residuals

	Close-Close			Open-Close			Close-Open		
Lag	**PAC**	**LB *Q*-Statistic[c]**	**Probability**	**PAC**	**LB *Q*-Statistic**	**Probability**	**PAC**	**LB *Q*-Statistic**	**Probability**
Day of the Week Model									
DJIA									
1	0.0070	0.1184		-0.0090	0.1876		-0.0130	0.4487	
2	0.0030	0.1486	0.7003	0.0300	2.5209	0.1120	-0.0380	4.0458	0.0440 [b]
3	-0.0410	4.4671	0.1070	-0.0060	2.6387	0.2670	-0.0070	4.1424	0.1260
4	-0.0280	6.5111	0.0890	-0.0030	2.6479	0.4490	0.0240	5.8150	0.1210
5	-0.0080	6.6919	0.1530	-0.0140	3.1676	0.5300	0.0170	6.5332	0.1630
SP 500 Index									
1	0.0060	0.0786							
2	0.0060	0.1841	0.6680						
3	-0.0490	6.3358	0.0420 [b]						
4	-0.0260	8.0962	0.0440 [b]						
5	-0.0320	10.6640	0.0310 [b]						
SP 500 Index Futures									
1	0.0010	0.0017		-0.0230	-0.0090		0.2234	1.3918	
2	-0.0080	0.1842	0.6680	-0.0190	0.0110	0.4710	0.5193	2.2422	0.1340
3	-0.0340	3.1209	0.2100	-0.0050	-0.0180	0.5100	1.3448	2.2925	0.3180
4	-0.0260	4.8277	0.1850	0.0040	-0.0120	0.6360	1.7046	2.3363	0.5060
5	-0.0360	7.9998	0.0920	-0.0090	-0.0330	0.3530	4.4162	2.5293	0.6390
Monday Model									
DJIA									
1	0.0070	0.1311		-0.0120	0.3348		-0.0020	0.0069	
2	0.0010	0.1370	0.7110	0.0290	2.4223	0.1200	-0.0380	3.6604	0.0560
3	-0.0380	3.7143	0.1560	-0.0050	2.5168	0.2840	-0.0060	3.7480	0.1540
4	-0.0280	5.8340	0.1200	-0.0030	2.5330	0.4690	0.0270	5.8627	0.1180
5	-0.0110	6.1840	0.1860	-0.0140	3.0262	0.5530	0.0120	6.2742	0.1800
SP 500 Index									
1	0.0040	0.0411							
2	0.0050	0.1156	0.7340						
3	-0.0490	6.1059	0.0470 [b]						
4	-0.0260	7.9046	0.0480 [b]						
5	-0.0310	10.3910	0.0340 [b]						
SP 500 Index Futures									
1	0.0040	0.0459		-0.0090	0.2097		-0.0260	1.6961	
2	-0.0100	0.2733	0.6010	0.0100	0.4667	0.4940	-0.0190	2.5234	0.1120
3	-0.0340	3.2319	0.1990	-0.0180	1.3165	0.5180	-0.0050	2.5700	0.2770
4	-0.0260	4.9285	0.1770	-0.0120	1.6516	0.6480	0.0030	2.6053	0.4570
5	-0.0360	8.0366	0.0900	-0.0320	4.2027	0.3790	-0.0090	2.8134	0.5900

[a] Significant at the one percent level.
[b] Significant at the five percent level.
[c] The Q-statistic at lag k is a test statistic for the null hypothesis that there is no autocorrelation up to order k.

Table 15
Residual Test: Q-Statistics of Standardized Residuals Squared

Lag	Close-Close PAC	Close-Close LB *Q*-Statistic	Close-Close Probability	Open-Close PAC	Open-Close LB *Q*-Statistic	Open-Close Probability	Close-Open PAC	Close-Open LB *Q*-Statistic	Close-Open Probability
Day of the Week Model									
DJIA									
1	0.0030	0.0229		0.0670	11.4770		0.0110	0.2853	
2	0.0190	0.9038	0.3420	0.0090	11.9140	0.0010 [a]	0.0270	2.1587	0.1420
3	-0.0230	2.2599	0.3230	-0.0200	12.7490	0.0020 [a]	0.0120	2.5409	0.2810
4	0.0020	2.2672	0.5190	-0.0040	12.8460	0.0050 [a]	-0.0040	2.5672	0.4630
5	-0.0040	2.3310	0.6750	-0.0110	13.2210	0.0100 [a]	0.0070	2.6951	0.6100
SP 500 Index									
1	-0.0050	0.0632							
2	0.0200	1.1078	0.2930						
3	-0.0150	1.6938	0.4290						
4	0.0030	1.7244	0.6320						
5	0.0040	1.7577	0.7800						
SP 500 Index Futures									
1	-0.0140	0.4938		0.0440	4.8412		0.0120	0.3740	
2	0.0250	2.0428	0.1530	0.0200	6.0011	0.0140 [b]	0.0100	0.6417	0.4230
3	-0.0140	2.5870	0.2740	-0.0180	6.6697	0.0360 [b]	0.0180	1.4563	0.4830
4	-0.0020	2.5882	0.4600	-0.0060	6.8117	0.0780	-0.0160	2.0242	0.5670
5	0.0080	2.7130	0.6070	-0.0100	7.1332	0.1290	-0.0030	2.0478	0.7270
Monday Model									
DJIA									
1	0.0020	0.0075		0.0650	10.6040		0.0130	0.4344	
2	0.0200	1.0577	0.3040	0.0150	11.4930	0.0010 [a]	0.0260	2.2093	0.1370
3	-0.0220	2.2463	0.3250	-0.0200	12.2550	0.0020 [a]	0.0100	2.5122	0.2850
4	0.0030	2.2827	0.5160	-0.0040	12.3400	0.0060 [a]	0.0020	2.5391	0.4680
5	-0.0050	2.3608	0.6700	-0.0100	12.6730	0.0130 [a]	0.0080	2.7119	0.6070
SP 500 Index									
1	-0.0060	0.0983							
2	0.0220	1.3178	0.2510						
3	-0.0160	1.9746	0.3730						
4	0.0030	2.0049	0.5710						
5	0.0040	2.0382	0.7290						
SP 500 Index Futures									
1	-0.0160	0.6142		0.0420	4.4847		0.0130	0.4140	
2	0.0260	2.3001	0.1290	0.0200	5.6775	0.0170 [b]	0.0100	0.6560	0.4180
3	-0.0150	2.9206	0.2320	-0.0170	6.3018	0.0430 [b]	0.0180	1.4563	0.4830
4	-0.0020	2.9231	0.4040	-0.0070	6.4624	0.0910	-0.0160	2.0448	0.5630
5	0.0080	3.0595	0.5480	-0.0100	6.7687	0.1490	-0.0040	2.0774	0.7220

[a] Significant at the one percent level.
[b] Significant at the five percent level.
[c] The *Q*-statistic at lag *k* is a test statistic for the null hypothesis that there is no autocorrelation up to order *k*.

The analysis indicates that the variance equation is correctly specified for all data sets except the DJIA open-to-close and SP 500 index futures open-to-close for both the day of the week and Monday models. The LB *Q*-statistic indicates that there is additional significant autocorrelation up to order five in the DJIA and order two in the SP 500 futures open-to-close returns. This autocorrelation is statistically significant (different from zero) but not economically significant as the coefficients are small in magnitude.[53] To insure that the standardized residuals did not exhibit additional ARCH effects the Engle's Lagrange multiplier (LM) test statistics were generated for all of the returns. In addition, the Jarque-Bera statistic, skewness and kurtosis are reported to test whether the standardized residuals are normally distributed.[54] The results are reported in Table 12 for the day of the week model and in Table 13 for the Monday model.

[53] A separate analysis was performed on the DJIA and SP 500 index futures' returns to identify the autocorrelations. They were found to be statistically significant but small in magnitude therefore not economically insignificant.

[54] For a complete look at the normality tests, histograms and the ARCH LM tests, see Appendix 4.

Question 3: Are anomalous end-of-day (or intraday) return patterns evident for the DJIA over the decade of the 1990's? If yes, are these patterns consistent with a change in market microstructure?

Comparison with Smirlock and Starks (1986)

The seminal paper by French (1980) identifies the anomalous behaviour of Monday SP 500 index returns. Over the period 1953-1977, French finds Monday's close-to-close return is negative and statistically different from the other four trading days of the week. This phenomenon has become known as the Monday effect. Smirlock and Starks (1986) examine DJIA returns from 1963-1983 on a close-to-close (closing returns), close-to-open (opening returns) and open-to-close (intraday returns) basis to confirm the existence and timing of the anomalous behaviour. This section of the paper extends the research to the DJIA returns for the period 1990-1999.

Closing Returns

The first objective is to determine the existence of any anomalous trading period behaviour in the DJIA for the periods 1963-1974, 1974-1983 and 1990-1999.[55] The time decomposed returns for the DJIA by day of the week and sample period are reported in Table 16.[56] Return series are calculated for close-to-close (R^c), close-to-open (R^o) and open-to-close (R^d). R^c is defined as the percentage change in the DJIA from the close of day t-1 to the close of day t; R^o is defined as the percentage change in the DJIA from the close of day t-1 to the open of day t; and R^d is the percentage

[55] Smirlock and Starks divided sample period into subperiods that were based on institutional characteristics. The first period 1963-1974 marks the change in settlement periods and contains several minor hourly return data problems. Days after market holidays were omitted from all subperiods.
[56] Important to note the research applies only to high capitalized stocks and inferences about time decomposed Monday returns cannot be made about low capitalized stocks.

return in the DJIA from the open of day t to the close of day t which represents the intraday returns. The F_1 statistic tests the hypothesis of equal returns across all five days of the week and the F_2 statistic tests the hypothesis of equal returns Tuesday through Friday. T-values based on null hypothesis the mean equals zero.

On a close-to-close basis, the results for 1963-1983 were consistent with the work of French with Monday returns being significantly negative. Monday returns were negative and twice as large in absolute magnitude as the next highest weekday. Interestingly, when the period is divided into subperiods, the subperiod 1968-1974 support the overall period results of returns being different across the days of the week (F_1=4.64) at the one percent level of significance, but the results for the 1974-1983 subperiod for DJIA close-to-close, while Monday is still negative, Monday is not significantly different from zero (t=-0.048) and there are no significant differences across the days of the week (F_1=0.97).

The period from 1990-1999 confirms returns on Monday are significantly different from zero (t=3.60) but the sign has changed. Monday returns on a close-to-close basis are highly significant and positive. The absolute magnitude of Monday returns is nearly three times that of the next highest day. There are significant differences across the days of the week (F_1=3.28) at the five percent level. The only significant results on a close-to-close basis during this time period occur on Monday. It is interesting to note that the sign of all days of the week is positive except for Thursday, which has a negative sign.

Table 16

Time Decomposed Returns: Close-to-Close (R^c), Close-to-Open (R^o) and Open-to-Close (R^d) for the DJIA by day of the week and sample period. Comparative Results with Smirlock and Starks (1986)

Sample Period	Variable[a]	Statistic	Monday	Tuesday	Wednesday	Thursday	Friday	All Days	F_1	F_2
1968-1974	R^c	Mean	-0.2152	-0.0207	0.0696	0.0368	0.0238	-0.0203	4.64 [a]	0.52
		t-value	(-3.93) [a]	(-0.44)	(1.23)	(0.70)	(0.49)	(-0.87)		
	R^o	Mean	-0.0264	-0.0328	0.0174	0.0363	0.0152	0.0018	1.45	1.41
		t-value	(-0.98)	(-1.37)	(0.66)	(1.49)	(0.68)	(0.17)		
	R^d	Mean	-0.1933	0.0119	0.0522	0.0004	0.0008	-0.0230	5.19 [a]	0.30
		t-value	(-4.45) [a]	(0.31)	(1.13)	(0.01)	(0.22)	(-1.22)		
	Obsevations		305	316	313	305	317	1556		
1974-1983										
	R^c	Mean	-0.0153	0.0047	0.0764	0.0115	0.083	0.0331	0.97	0.85
		t-value	(-0.48)	(0.26)	(1.7)	(0.68)	(1.96)	(1.64)		
	R^o	Mean	-0.0714	0.0086	-0.0174	0.0319	0.0137	-0.006	3.20 [b]	0.89
		t-value	(-3.13) [a]	(0.38)	(-0.81)	(1.46)	(0.62)	(-0.61)		
	R^d	Mean	0.0551	-0.0039	0.0939	-0.0203	0.0692	0.039	1.52	1.97
		t-value	(1.34)	(-0.09)	(2.41) [b]	(-0.51)	(1.73)	(2.18) [b]		
	Obsevations		422	437	473	463	449	2244		
1990-1999										
	R^c	Mean	0.1668	0.0496	0.0535	-0.0378	0.0503	0.0548	3.24 [b]	1.35
		t-value	(3.63) [a]	(1.26)	(1.60)	(-0.93)	(1.24)	(3.06) [a]		
	R^o	Mean	-0.0026	0.0377	0.0202	0.021	0.0567	0.0249	1.13	0.92
		t-value	(-0.01)	(1.96)	(1.13)	(0.56)	(2.39) [b]	(2.60) [a]		
	R^d	Mean	0.1694	0.0119	0.0333	-0.0498	-0.0064	0.0299	5.14 [a]	1.05
		t-value	(4.15) [a]	(0.31)	(1.04)	(-1.52)	(-0.18)	(1.85)		
	Observations		463	479	513	502	489	2446		

[a] Significant at the one percent level.

[b] Significant at the five percent level.

[c] F_1 is testing the hypothesis of equal returns across all five weekdays.

[d] F_2 tests the hypothesis of equal returns Tuesday through Friday.

[e] *t*-value based on null hypothesis the mean equals zero.

[f] The 1968-1974 subperiod is from 10 February 1968 through 30 September 1974; the subperiod 1974-1983 is from 1 October 1974 through 31 December 1983; and the subperiod 1990-1999 is from 1 January 1990 through 31 December 1999. To be consistant with Smirlock and Starks, days after holidays were omitted.

[g] R^c is defined as the percentage change in the DJIA from the close of day t-1 to the close of day t. R^o is defined as the percentage change in the DJIA from the close of day t-1 to the open of day t. R^d is defined as the percentage change in the DJIA from the open of day t to the close of day t.

Opening and Intraday Returns

To further determine the timing of the returns, it is important to decompose R^c into its component parts, R^o and R^d. The summary statistics from Smirlock and Starks (1986) for the DJIA from 1968 through 1983 are reported and compared to the period 1990 through 1999 for the DJIA return data in Table 16. To formally test the hypothesis that the mean returns for any hour across all days are equal, the F-statistics are reported in the column labelled F_1. The F-statistic testing equality of hourly returns for all days excluding Monday is reported in column F_2.

Smirlock and Starks found differences in the results when the close-to-close returns where decomposed into opening and intraday returns. In the period 1974-1983 returns indicate a non-trading period or weekend effect with Monday's opening returns being twice in absolute magnitude to any other day and significantly negative while the intraday returns are positive and not significantly different from the other days of the week. In contrast, the 1968-1974 period while still negative on the opening on Monday exhibits the most significant results on Monday intraday returns at –0.1933%. This Monday return is four times the magnitude of R^o or R^d for any other day of the week. The entire return day pattern occurs during the trading day (Monday trading period effect) during the 1968-1974 period while the 1974-1983 period is marked by stronger opening returns or weekend effect.[57]

For the period 1990-1999, returns occurred completely during the trading day with Monday returns exhibiting at least three times the absolute returns for any other day of the week and they are extremely large and positive at the one percent level (t=4.15). However, the negative sign on Monday opening returns indicates there is

[57] These results highlight the importance of differentiating a Monday effect or day of the week effect from a weekend effect. The work of French (1980) coined the term weekend effect but in reality discovered a Monday trading period effect.

still weak selling pressure on the opening Monday. There are significant differences at the one percent level across the days of the week on a open-to-close (intraday) basis (F_1=5.14) with the only significant results occurring on Monday. There are no significant differences across the days of the week on a close-to-open basis.

Smirlock and Starks found a shift in the weekend effect from a trading time (Monday effect) to a non-trading time (weekend effect) effect over the 1968-1983 period. For the period 1990-1999, the anomalous behaviour has returned to a trading time effect. This supports the proposition that return patterns are dynamic and not static and care should be taken when analysing the return patterns over a long period of time.

Intraday pattern of returns

Comparison with Smirlock and Starks (1986)

Over the pre-1974 and 1990-1999 periods, the anomalous behaviour occurred during the trading day and not from Friday's close to Monday's open. The anomalous return pattern occurred in the non-trading period for the 1974 through 1983 period. Therefore, the next objective is to determine whether Monday's return pattern is consistent over the entire day or is it predominately focused on some specific time of the day for the different periods of time.

To analyse the issues concerning the intraday pattern of returns, data was collected for the DJIA hourly returns for each day of the week for the period 1990 through 1999. In addition, half-hourly returns were collected for

3:00pm-3:30pm and 3:30pm-4:00pm.[58] Six different return series are calculated: R_t^i, where i=11, 12, 1, 2, 3, 4. Hourly returns are calculated as the percentage

[58] For a complete analysis of the summary statistics for the intraday returns, see Appendix 7.

change in the DJIA from hour i-1 to hour i on day t. Summary results from Smirlock & Starks (1986) work and the current study are presented in Table 17 for the six hourly return measures across days for each subperiod. F_1 tests the null hypothesis that the mean returns for any hour across all days are equal and F_2 tests the equality of hourly returns for Tuesday through Friday. T-values are based on the null hypothesis the mean equals zero.

Over the period 1968-1974 Monday exhibits the largest hourly returns in absolute magnitude and are negative in the first two hours of trading. In fact, these two hours account for nearly all of the weekend effect for the entire subperiod. This confirms a trading day or Monday effect.

On the other hand, the 1974-1983 subperiod return pattern is quite different. There are significant negative returns for the first two hours on Monday and returns for all other days are positive. The magnitude of the negative Monday return in the first hour is nearly identical to the close-to-open results for Monday in Table 16. The rest of the day consumes the negative returns and ends up with the returns being positive over the trading day period.

The 1990-1999 hourly returns for Monday continue to exhibit statistically significant results for the first two hours. However, the sign has switched to positive. All other days have a negative coefficient in the first hour of trading and Thursday and Friday having significantly negative returns. Additionally, the last hour of trading for this subperiod contains significant return patterns on Monday, Tuesday and Wednesday that were not exhibited in the prior subperiods. This is consistent with the findings of Smirlock and Starks (1986) that there is a shift up in time in the pattern of hourly returns on Monday. It is also consistent with the trading strategies used by index fund managers who tend to invest inflows near the end of the trading day.

For all periods, the null hypothesis of equal hour returns for all days of the week is rejected for the first trading hour. When the null hypothesis the returns across Tuesday through Friday are equal is tested, with the exception of R^{12} for the 1974-1983 period, there are no significant results. The evidence suggests there is a time of day effect in returns for Monday that are different from those resulting for the other days of the week.

Additional Analysis of the DJIA 1990-1999 subperiod

Table 18 refines the results from Tables 16 and 17 for the subperiod 1990-1999. Tables 16 and 17 remained consistent with Smirlock and Starks(1986) by removing post-holiday returns from the analysis. In this table, the returns for pre-holiday, post-holiday and early closures have been removed. In addition, the end of day is time decomposed into thirty-minute periods. The only negative sign on a close-to-open basis is Monday. This is consistent with selling pressure over the weekend. In addition, there are significant return patterns from 3:00pm EST to the 4:00pm EST close for each day of the week. This return pattern is consistent with money flows being a significant contributing factor to seasonal patterns.

Table 17
Intraday Pattern of Returns
for the DJIA by day of the week and sample period.[d]
Comparative Results with Smirlock and Starks (1986)

Sample Period	*Variable*[c]	Statistic	Monday[d]	Tuesday	Wednesday	Thursday	Friday	All Days	F_1[e]	F_2[f]
1963-1983										
	R^{11}	Mean	-0.0653 [a]	0.0272 [a]	0.0429 [a]	0.0341 [a]	0.0072	0.0101 [b]	19.18 [a]	2.42
		t-value	(-6.33)	(2.90)	(4.25)	(3.50)	(0.77)	(2.28)		
	R^{12}	Mean	-0.0455 [a]	-0.0188 [a]	0.0093	-0.0302 [a]	-0.0077	-0.0182 [a]	5.34 [b]	3.53 [b]
		t-value	(-5.34)	(-2.01)	(0.95)	(-3.34)	(-0.82)	(-4.48)		
	R^{1}	Mean	-0.0103	0.0051	0.0095	0.0072	0.0090	0.0042	1.31	0.07
		t-value	(-1.56)	(0.69)	(1.33)	(0.97)	(1.34)	(1.35)		
	R^{2}	Mean	0.0288 [a]	0.0232 [a]	0.0270 [a]	0.0275 [a]	0.0187 [b]	0.0250 [a]	0.30	0.30
		t-value	(4.33)	(2.76)	(3.75)	(3.81)	(2.50)	(7.55)		
	R^{3}	Mean	0.0134	-0.0312 [a]	-0.0184	-0.0384 [a]	-0.0112	-0.0174 [a]	4.12 [b]	1.58
		t-value	(1.33)	(-3.04)	(-1.73)	(-3.84)	(-1.44)	(-3.96)		
	R^{4}	Mean	0.0056	-0.0039	0.0041	-0.0214	0.0300 [a]	0.0030	3.01 [b]	3.99 [b]
		t-value	(0.53)	(-0.34)	(0.49)	(-1.92)	(3.81)	(0.63)		
		Observatio	918	947	992	977	965	4799		
1968-1974										
	R^{11}	Mean	-0.1049 [a]	0.0014 [a]	0.0328	0.0318	-0.0281	-0.0132	8.64 [a]	2.37
		t-value	(-5.42)	(0.08)	(1.66)	(1.55)	(-1.56)	(-1.54)		
	R^{12}	Mean	-0.0669 [a]	-0.0060 [a]	0.0134	-0.0242	-0.0201	-0.0253 [a]	3.04 [b]	0.98
		t-value	(-4.34)	(-0.35)	(0.70)	(-1.46)	(-1.19)	(-2.67)		
	R^{1}	Mean	-0.0402	-0.0037	-0.0077	-0.0071	0.0051	-0.0106	1.75	0.19
		t-value	(-3.20)	(-0.30)	(-0.59)	(-0.49)	(0.40)	(-1.85)		
	R^{2}	Mean	0.0015 [a]	0.0323 [a]	0.0232	0.0171	0.0382 [b]	0.0227 [a]	2.49	1.57
		t-value	(0.13)	(2.11)	(1.82)	(1.37)	(2.48)	(3.72)		
	R^{3}	Mean	0.0099	-0.0059 [a]	0.0014	-0.0094	0.0008	-0.0006	0.18	0.09
		t-value	(0.61)	(-0.39)	(0.07)	(-0.50)	(0.06)	(-0.08)		
	R^{4}	Mean	0.0081	-0.0083	-0.0141	-0.0109	0.0195	-0.0009	1.17	1.37
		t-value	(0.60)	(-0.66)	(-1.04)	(-0.66)	(1.94)	(-0.15)		
		Observatio	305	316	313	305	317	1556		

Table 17 continued.

1974-1983									
	R^{11}	Mean	-0.0626 [a]	0.0227	0.0279 [b]	0.0250	0.0084	0.0166	6.55 [a]	0.35
		t-value	(-5.17)	(1.81)	(1.98)	(1.72)	(0.91)	(1.92)		
	R^{12}	Mean	-0.0275 [a]	-0.0269 [b]	0.0164	-0.0320 [a]	0.0068	-0.0337 [a]	2.69 [b]	3.11 [b]
		t-value	(-2.13)	(-2.21)	(1.49)	(-2.71)	(0.39)	(-4.75)		
	R^{1}	Mean	0.0219	0.0247 [b]	0.0260 [a]	0.0300 [b]	0.0220 [b]	0.0250 [a]	0.08	0.08
		t-value	(1.97)	(2.17)	(2.61)	(2.47)	(2.03)	(5.0)		
	R^{2}	Mean	0.0630 [a]	0.0329 [a]	0.0391 [a]	0.0445 [a]	0.0109	0.0379 [a]	2.49	1.57
		t-value	(5.47)	(2.79)	(2.91)	(3.29)	(1.43)	(7.15)		
	R^{3}	Mean	0.0371 [b]	-0.0656 [a]	-0.0438 [a]	-0.0663 [a]	-0.0231	-0.0124	6.98 [a]	1.56
		t-value	(2.41)	(-4.71)	(-3.19)	(-4.79)	(-1.63)	(-1.96)		
	R^{4}	Mean	0.0239	0.0069	0.0274 [b]	0.0207	0.0466 [a]	0.0053	1.74	2.27
		t-value	(1.91)	(0.47)	(2.0)	(1.61)	(2.81)	(0.81)		
		Observatio	422	437	473	463	448	2239		
1990-1999									
	R^{11}	Mean	0.0576 [a]	-0.0275	-0.0236	-0.0364 [b]	-0.0556 [a]	-0.0180 [b]	5.45 [a]	0.62
		t-value[g]	(2.99)	(-1.47)	(-1.40)	(-2.12)	(-2.84)	(-2.20)		
	R^{12}	Mean	0.0256 [b]	0.0013	0.0181	-0.0198	0.0161	0.0080	2.03	1.84
		t-value	(2.34)	(0.10)	(1.60)	(-1.66)	(1.03)	(1.42)		
	R^{1}	Mean	0.0113	-0.0083	0.0184	-0.0143	-0.0078	-0.0001	1.72	1.71
		t-value	(1.27)	(-0.76)	(1.85)	(-1.37)	(-0.57)	(-0.03)		
	R^{2}	Mean	0.0150	-0.0014	-0.0076	0.0108	-0.0007	0.0030	0.77	0.54
		t-value	(1.37)	(-0.13)	(-0.69)	(1.09)	(-0.07)	(0.64)		
	R^{3}	Mean	0.0171	0.0033	-0.0091	-0.0069	0.0137	0.0032	0.76	0.59
		t-value	(1.32)	(0.22)	(-0.69)	(-0.56)	(1.01)	(0.54)		
	R^{4}	Mean	0.0424 [b]	0.0428 [b]	0.0392 [b]	0.0127	0.0265	0.0325 [a]	0.50	0.58
		t-value	(2.04)	(2.31)	(2.15)	(0.72)	(1.49)	(3.92)		
		Observatio	460	476	512	500	487	2435		

[a] Significant at the one percent level.

[b] Significant at the five percent level.

[c] R^{i}, (i=11,12,1,2,3,4) is defined as the percentage change in the DJIA from hour i-1 to hour i on day t.

[d] Consistent with Smirlock and Starks (1986), days after market holiday are omitted. Smirlock and Starks note the hourly return data during the

[e] F_1 is the F-statistic based on the null hypothesis of equal mean returns across Monday through Friday.

[f] F_2 is the F-statistic testing equality of hourly returns for all days excluding Monday.

[g] t-value based on null hypothesis that the mean equals zero.

[h] The 1968-1974 subperiod is from 10 February 1968 through 30 September 1974; the subperiod 1974-1983 is from 1 October 1974 through 31 December 1983; and the subperiod 1990-1999 is from 1 January 1990 through 31 December 1999. To be consistant with Smirlock and Starks, days after holidays were omitted.

Table18

Dow Jones Industrial Average Mean Hourly Returns: January 1, 1900 through December 31, 1999
Pre-holiday, Post-holidays and Early Closures Omitted

Day of the Week	Close/ Open	Open/ Close	Close/ Close	Open 12:00 PM	12:00/ Close	3:00/ 3:30 PM	3:30/ Close
MONDAY	-0.0020	0.1688	0.1668	0.0953	0.0847	0.0178	0.0241
t-value	(-0.08)	(4.10) *	(3.60) *	(3.91) *	(2.60) *	(1.75) ***	(1.48)
N = 459							
TUESDAY	0.0372	0.0138	0.0509	-0.0326	0.0387	0.0256	0.0183
t-value	(1.90) ***	(0.36)	(1.28)	(-1.19)	(1.34)	(2.30) **	(1.83)
N = 472							
WEDNESDAY	0.0219	0.0361	0.0580	0.0159	0.0387	0.0107	0.0299
t-value	(1.20)	(1.10)	(1.70) ***	(0.72)	(1.42)	(0.87)	(2.31) **
N = 499							
THURSDAY	0.0030	-0.0454	-0.0424	-0.0641	0.0067	-0.0084	0.0240
t-value	(0.14)	(-1.35)	(-1.02)	(-2.73) *	(0.25)	(-0.71)	(1.75) ***
N = 482							
FRIDAY	0.0569	-0.0069	0.0499	-0.0494	0.0343	0.0040	0.0260
t-value	(2.27) **	(-0.18)	(1.17)	(-1.74) ***	(1.19)	(0.37)	(1.79) ***
N = 448							
TU-FRI	0.0292	-0.0003	0.0289	-0.0318	0.0295	0.0080	0.0246
t-value	(2.74) *	(-0.01)	(1.46)	(-2.52) **	(2.12) **	(1.37)	(3.56) *
N = 1901							
ALL DAYS	0.0231	0.0326	0.0557	-0.0071	0.0403	0.0099	0.0245
t-value							
N = 2360	(2.35) **	(1.97) **	(3.05) *	(-0.63)	(3.12)	(1.94) ***	(3.83) *
F_1		4.81 *	3.28 **	6.51 *	0.93	1.32	0.09
F_2		0.96	1.49	1.95	0.31	1.48	0.13
t_1		4.06 *	2.98 *	4.47 *	1.69 ***	0.76	0.01

***,**,* Significant at the 0.10, 0.05 and 0.01 level, respectively. Returns = natural logarithm of price relative.
F_1 is testing the hypothesis that returns are equal Monday through Friday.
F_2 is testing the hypothesis that returns are equal Tuesday through Friday.
t_1 is testing the hypothesis that returns are equal Monday versus Tuesday-Friday.
(t) is testing null hypothesis that the mean equals zero.

To add additional information to the idea of money flow contributions to the seasonal pattern, Table 19 and Figure 11 expand the analysis to the standard deviations of the returns for the 1990-1999 subperiod. Standard deviations should be more reflective of information flows or noise. As can be seen in Table 18 and Figure 11, there appears to be nothing unusual about the standard deviations. They are uniform across the days of the week. Figure 12 highlights the U-shape of the standard deviations for all days, which is consistent with past research on the U-shape in intraday mean returns and volatility. [59]

Table 19

DJIA Mean Hourly Returns: January 1, 1990 through December 31, 1999
Table of Standard Deviations
Pre-holidays, Post-Holidays and Early Closures Omited

Variable[a]	Monday	Tuesday	Wednesday	Thursday	Friday	All Days
Close-to-Open	0.5289	0.4245	0.4073	0.4862	0.5312	0.4771
R^{10b}	0.2568	0.2315	0.2305	0.2395	0.2849	0.2503
R^{11}	0.3348	0.3282	0.3345	0.3256	0.3405	0.3325
R^{12}	0.2344	0.2774	0.2581	0.2653	0.3560	0.2807
R^{1}	0.1902	0.2402	0.2266	0.2357	0.3053	0.2419
R^{2}	0.2352	0.2286	0.2496	0.2224	0.2378	0.2351
R^{3}	0.2777	0.3334	0.3012	0.2766	0.3017	0.2989
R^{4}	0.4475	0.4033	0.4155	0.3952	0.3944	0.4133

[a] R^i, (i=11,12,1,2,3,4) is defined as the percentage change in the DJIA from hour i-1 to hour i on day t.

Figure 13 graphically presents the DJIA hour returns for the 1990-1999 subperiod by day of the week. These also provide evidence consistent with a hypothesis of money flows as a contributing factor. Return patterns are similar across days of the week during intraday trading periods. Monday shows evidence of selling pressure on the opening but otherwise is positive throughout the day. Tuesday shows positive returns on the opening, which is anecdotal evidence of a carry over effect from Monday, which is consistent with limit orders being entered on Monday but not filled until Tuesday.

[59] "The U-shaped pattern of intraday returns and volatility" have been documented in works by Harris (1986, 1989), Jain and Joh (1988), Wood McInish and Ord (1985), Smirlock & Starks (1986) and Block, French and Maberly (2000).

Figure 11
DJIA Mean Hourly Returns: January 1, 1990 through December 31, 1999
Graph of Standard Deviations

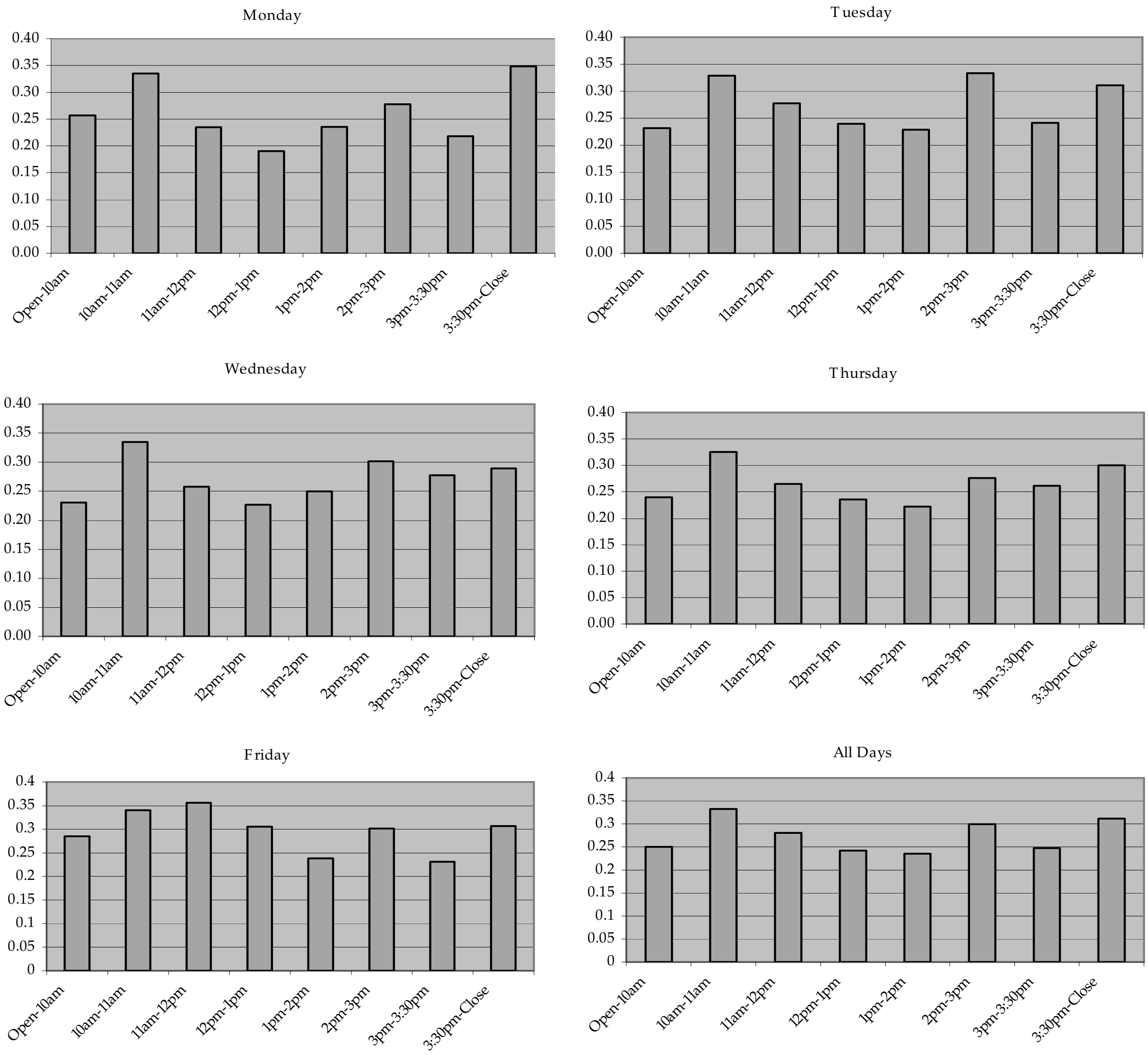


Figure 12
DJIA Hourly Return Standard Deviations
All Days

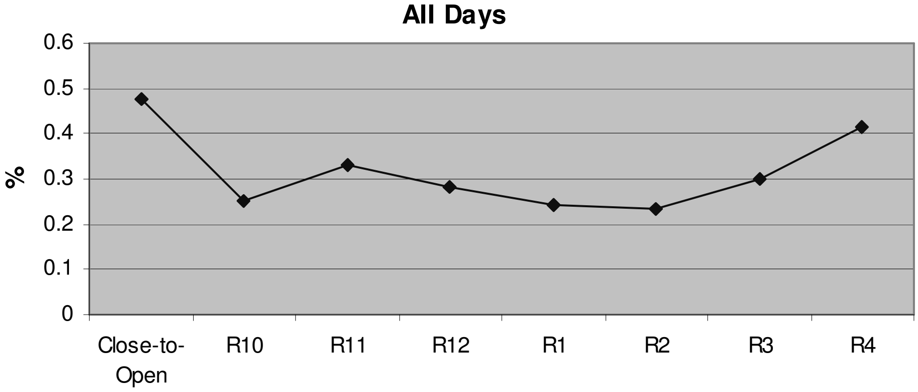


Figure 13
DJIA Mean Hourly Returns: January 1, 1990 through December 31, 1999
Graph of Mean Returns by Intraday Time Intervals

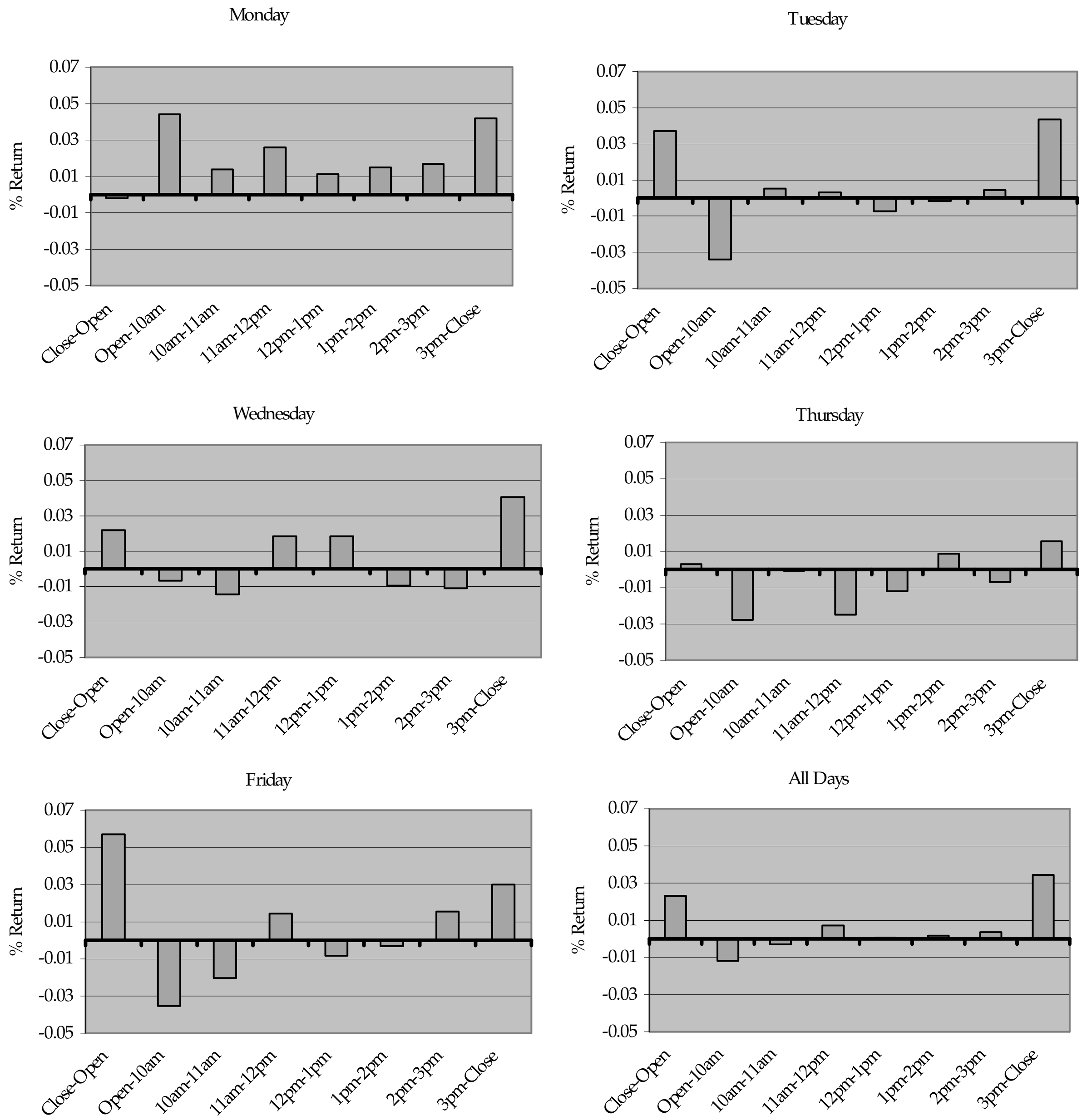
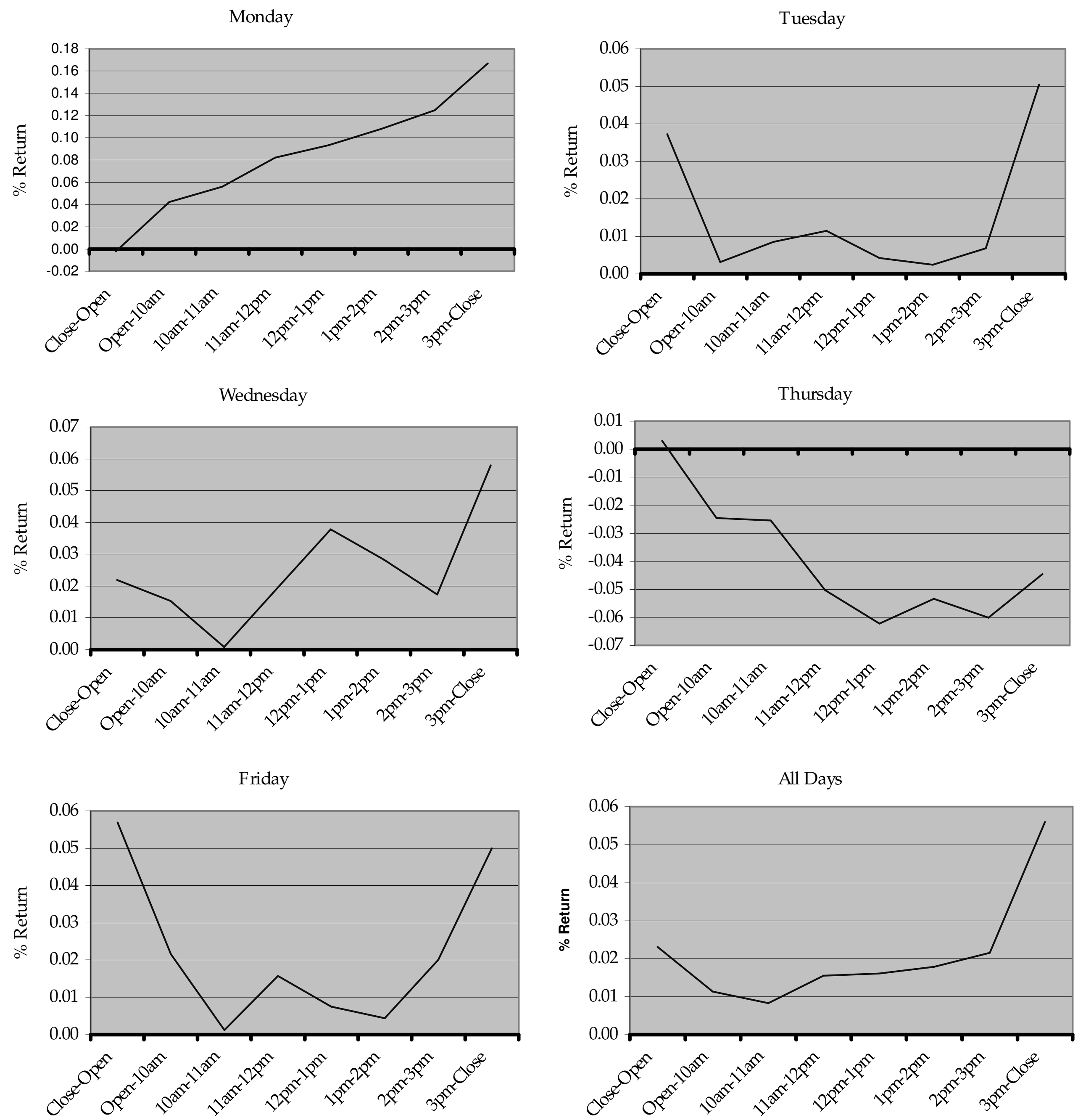


Figure 14 presents the DJIA cumulative mean hourly returns for the subperiod 1990-1999 by day of the week and is a refinement of Figure 13. The results for Tuesday through Friday are consistent with the results from past literature identifying the "U-shaped pattern of intraday returns." However, Monday exhibits a continuous increase throughout the day, which is distinctive from the other four days of the week.

Table 20 looks at the autocorrelations in the DJIA hourly mean returns. The autocorrelations between close-to-open and open-to-10am EST are significantly negative for all days of the week. This is evidence of price reversals on the opening due to the specialist systems of operation. If the specialist sees buying (selling) pressure on the open, then they are selling short (adding to their inventory) or liquidating their inventory to anticipate and thereby contribute to the observed reversal in price. In addition, there are large autocorrelations on Monday between 3:00pm-3:30pm EST and 3:30pm-4:00pm EST. This is consistent with money inflows from index funds at the end of the day.

Figure 14
DJIA Mean Hourly Returns: January 1, 1990 through December 31, 1999
Graph of Percent Cumulative Mean Returns



Note: Scaling is different for each day of the week.

Table 20
Autocorrelations DJIA Hourly Mean Returns

	Close/ Open	Open/ 10:00 AM	10:00/ 11:00 AM	11:00/ 12:00 PM	12:00/ 1:00 PM	1:00/ 2:00 PM	2:00/ 3:00 PM	3:00/ 3:30 PM	3:30/ 4:00 PM
					Monday				
Close/ Open	1.000	**-0.345**	0.110	-0.005	**0.135**	-0.101	0.014	**-0.126**	0.015
Open/ 10:00 AM		1.000	-0.037	0.056	-0.007	0.002	**-0.150**	0.053	0.004
10:00/ 11:00 AM			1.000	0.027	-0.010	0.008	0.040	-0.046	**0.137**
11:00/ 12:00 PM				1.000	0.012	0.012	0.067	0.033	**0.124**
12:00/ 1:00 PM					1.000	0.063	-0.021	0.051	0.017
1:00/ 2:00 PM						1.000	0.005	**0.130**	0.047
2:00/ 3:00 PM							1.000	**0.172**	**0.348**
3:00/ 3:30 PM								1.000	**0.207**
3:30/ 4:00 PM									1.000
					Tuesday				
Close/ Open	1.000	**-0.345**	-0.030	-0.116	**-0.134**	0.089	-0.113	0.056	-0.037
Open/ 10:00 AM		1.000	0.030	-0.007	0.098	0.017	0.080	0.016	0.020
10:00/ 11:00 AM			1.000	0.056	**0.127**	**-0.129**	0.000	-0.005	0.076
11:00/ 12:00 PM				1.000	0.091	-0.110	0.050	0.101	0.000
12:00/ 1:00 PM					1.000	**-0.255**	0.041	-0.066	**0.177**
1:00/ 2:00 PM						1.000	-0.050	-0.013	-0.086
2:00/ 3:00 PM							1.000	**0.174**	0.012
3:00/ 3:30 PM								1.000	0.052
3:30/ 4:00 PM									1.000
					Wednesday				
Close/ Open	1.000	**-0.318**	**-0.130**	0.065	-0.017	-0.032	-0.066	-0.019	-0.040
Open/ 10:00 AM		1.000	**-0.119**	0.001	0.018	-0.031	-0.024	-0.018	0.100
10:00/ 11:00 AM			1.000	-0.110	0.030	-0.031	-0.052	0.057	0.033
11:00/ 12:00 PM				1.000	-0.093	-0.078	-0.067	-0.008	-0.038
12:00/ 1:00 PM					1.000	**-0.116**	0.024	-0.069	-0.088
1:00/ 2:00 PM						1.000	0.077	0.009	-0.027
2:00/ 3:00 PM							1.000	0.090	-0.008
3:00/ 3:30 PM								1.000	0.076
3:30/ 4:00 PM									1.000
					Thursday				
Close/ Open	1.000	**-0.280**	0.057	**0.158**	0.046	0.016	-0.019	**0.190**	-0.010
Open/ 10:00 AM		1.000	**-0.167**	-0.043	0.011	0.036	-0.088	-0.069	-0.005
10:00/ 11:00 AM			1.000	0.019	0.010	0.061	-0.040	**0.128**	0.010
11:00/ 12:00 PM				1.000	0.017	-0.105	**-0.169**	**0.137**	-0.035
12:00/ 1:00 PM					1.000	0.014	-0.028	-0.011	0.039
1:00/ 2:00 PM						1.000	-0.029	0.019	-0.007
2:00/ 3:00 PM							1.000	-0.003	0.066
3:00/ 3:30 PM								1.000	-0.015
3:30/ 4:00 PM									1.000
					Friday				
Close/ Open	1.000	**-0.293**	**-0.176**	-0.027	0.091	0.097	-0.024	-0.005	0.004
Open/ 10:00 AM		1.000	-0.028	0.082	-0.028	0.027	0.017	0.036	0.071
10:00/ 11:00 AM			1.000	-0.007	-0.056	-0.085	-0.094	-0.069	0.091
11:00/ 12:00 PM				1.000	**-0.223**	-0.031	0.016	0.053	-0.003
12:00/ 1:00 PM					1.000	0.080	-0.117	0.021	-0.045
1:00/ 2:00 PM						1.000	**-0.136**	-0.072	0.058
2:00/ 3:00 PM							1.000	0.004	0.059
3:00/ 3:30 PM								1.000	0.060
3:30/ 4:00 PM									1.000

Different from zero at the 0.01 level.

Question 4: Is there a significant difference in the Monday's NYSE volume and Monday's NYSE odd-lot volume over the decade of the 1990's versus that reported by prior empirical studies – Lakonishok and Maberly (1990)?

NYSE Trading Volume by day of the week[60]

Table 21 contains results for NYSE trading volume (in millions of shares) by day of the week. The results of L&M (1990) for the 25-year period 1962 through 1986 and the 10-year period 1990 through 1999 are presented and compared. Evidence from L&M indicates trading volume is lowest on Monday relative to other days of the week. The average trading volume for Monday is 33.77 million shares versus an average of 37.28 million shares across all days of the week and 38.12 million shares for Tuesday through Friday. This implies a decrease of more than ten percent in trading volume on Monday and is significantly different from the other days of the week at the one percent level with a t-statistic of –3.54. The null hypothesis that the mean trading volume is the same across all days of the week can be rejected at the five percent level with an F-statistic of 3.12. Excluding Monday, the null hypothesis that the mean trading volume is the same Tuesday through Friday cannot be rejected. The results for the median trading volume are similar to those reported for the mean. The 5-year period of 1982-1986 are consistent with the results for the total period; the lowest trading volume always occurs on Monday.

[60] For a complete look at the descriptive statistics for the volume data see Appendix 5

Table 21

NYSE Trading Volume in Millions of Shares by Day of the Week

Comparative Results with Lakonishok and Maberly (1990)

Source: Wall Street Journal for the NYSE, 1990-1999. The *t*-statistic is testing the hypothesis that the mean trading volume on the particular day is equal to the average across the other four trading days of the week. The *F*1-statistic is testing the hypothesis that the mean trading volume across all days of the week is the same. The *F*2-statistic is testing the hypothesis that the mean trading volume across the four days of the week, excluding Monday is the same.

	Monday	Tuesday	Wednesday	Thursday	Friday	All Days	*F*1*	*F*2*
Period 1962-1986								
Mean	33.770	37.930	39.020	38.620	36.890	37.280	3.120 [b]	0.590
Median	16.690	18.580	19.010	18.840	17.880	18.280		
t-statistic	-3.540 [a]	0.620	1.620	1.240	-0.360			
Period 1982-1986								
Mean	97.440	108.930	113.820	112.310	107.360	108.090	8.930 [a]	1.880
Median	93.670	105.280	108.690	107.690	101.370	103.620		
t-statistic	-6.050 [a]	0.450	3.080 [a]	2.190 [b]	-0.350			
Period 1990-1999								
Mean	361.050	390.490	396.940	395.630	383.660	385.870	3.190 [b]	0.460
Median	294.120	325.940	336.500	320.240	311.070	313.580		
Std. Dev.	214.610	221.060	223.680	225.180	219.810	221.180		
t-statistic	-3.280 [a]	0.670	1.470	1.370	-0.190			
n	482	519	516	508	503	2528		

*All statistical tests use the log normal transformation.

** t-test is a two sample test with an unequal variance assumption.

[a] Significant at the one percent level for a two-tailed test.

[b] Significant at the five percent level for a two tailed test.

The results for the ten-year period 1990-1999 are similar to the prior reported periods. Trading volume is lowest on Monday relative to other days of the week. The average trading volume on Monday is 361.05 million shares versus an average of 385.87 million shares across all days of the week and 391.68 million shares for Tuesday through Friday. This implies a 8.5 percent decrease in trading volume on Monday. Monday volume continues to be significantly different from the trading volume of the other days of the week at the one percent level with a t-statistic of –3.28. The null hypothesis that the mean trading volume is the same across all days of the week is rejected at the five percent level with an F-statistic of 3.19. If Monday is excluded, the null hypothesis that the mean trading volume is the same Tuesday through Friday cannot be rejected at a meaningful level.

In all trading periods presented, trading volume appears to be slightly higher in the middle of the week, particularly on Wednesday. There has been more than a 370 percent increase in trading volume since the final sub-period of 1982-1986 in the L&M (1990) paper. The increased volume and the continued decreased activity on Monday is consistent with the increased importance of institutional investors in the market relative to individual investors.

Table 22
NYSE Odd-Lot Sales Plus Odd-Lot Purchases as a Percentage of NYSE Trading Volume
Comparative Results with Lakonishok and Maberly (1990)

Source: Barron's Magazine for the Odd-Lot Purchases and Sales for 1990-1999. The *t*-statistic is testing the hypothesis that odd-lot sales plus odd-lot purchases divided by NYSE trading volume on the particular date is equal to the average across the other four trading days of the week. The *F*1-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week. The *F*2-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week, excluding Mondays.*

	Monday	Tuesday	Wednesday	Thursday	Friday	All Days	*F*1	*F*2
Period 1962-1986								
Mean	6.550	5.880	5.570	5.520	5.610	5.820	6.460 [a]	1.000
Median	4.260	3.730	3.460	3.510	3.540	3.670		
t-statistic	4.450 [a]	0.390	-1.750	-2.120 [b]	-1.410			
Period 1982-1986								
Mean	0.700	0.630	0.580	0.570	0.600	0.610	70.990 [a]	18.260 [a]
Median	0.690	0.620	0.570	0.570	0.540	0.600		
t-statistic	13.430 [a]	2.080 [b]	-7.110 [a]	-8.480 [a]	-2.550 [b]			
Period1990-1999								
Mean	0.861	0.847	0.817	0.801	0.815	0.827	11.190 [a]	6.310 [a]
Median	0.848	0.813	0.788	0.780	0.790	0.802		
Std. Dev.	0.166	0.191	0.167	0.165	0.179	0.175		
t-statistic**	5.240 [a]	2.720 [a]	-1.570	-4.000 [a]	-2.070 [b]			
n	481	520	516	508	503	2528		

*All statistical tests use the log normal transformation.
** t-test is a two sample test with an unequal variance assumption.
[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two tailed test.

Trading Activity of Individuals by Day of the Week

Table 22 contains the L&M (1990) results by day of the week for 1962-1986 period and the 1982-1986 sub-period. These results are compared to the results for the 1990-1999 period, which is the focus of this study. In all cases, odd-lot sales plus odd-lot purchases as a percentage of NYSE trading volume is used as a proxy for the relative trading activity of individual investors. In all periods, the results indicate that individual investors are most active in the market on Monday. Monday's odd-lot trading over the period 1962-1986 was 6.55 percent of NYSE trading volume, versus an average of 5.82 percent for Monday through Friday and an average of 5.64 percent for Tuesday through Friday. In the period 1990-1999, Monday's odd-lot trading volume is 0.861 percent of NYSE trading volume compared to an average of 0.827 percent across all days and 0.819 percent Tuesday-Friday. Based on a two-sample t-test for equal means, individual trading activity on Monday is significantly larger at the one percent level versus trading activity Tuesday-Friday. In all three sub-periods examined in Table 22, Tuesday is the only day other than Monday where individual trading volume is above the weekly average. This observation is potentially due to some carry over of orders from Monday to Tuesday. For example, limit orders placed over the weekend or on Monday might not fill at the limit price. These orders potentially become market orders during the trading day on Tuesday.[61] The null hypothesis that the mean odd-lot trading activity is identical across all days of the week is rejected in all three sub-periods at the one percent level. Excluding Monday,

[61] A related issue is the timing of Monday's order flow into mutual funds, but in particular index funds. If Monday's order flow is received after 4:00pm EST, then the money is deemed received on Tuesday, and in the case of index funds, more than likely invested near the close on Tuesday. In this case, Tuesday's end of the day returns should be unusually large. If brokers receive a large number of order flow tickets during the trading day for a particular mutual fund or a particular family of funds, then to save processing time, the broker might "batch the orders" (enter as one ticket) after the market closes at 4:00pm EST. In this scenario, the money would be invested on Tuesday, but the trading decision was made on Monday.

the null hypothesis of equal means Tuesday-Friday is rejected for the two most recent sub-periods at the one percent level.

Consistent with the observation by L&M (1990) for the period 1962-1986, odd-lot transactions have decreased dramatically from 6.55 percent to less than 1 percent of NYSE trading volume in the most recent period. L&M offer two possible explanations for the decrease over time in odd-lot transactions. First, the role of institutional investors has increased substantially since 1982. Second, the average price of a security listed on the NYSE has not changed much over the period 1962-1999. The average price of NYSE listed securities in 1966 was $44.70, in 1986 was $38.60 and in 1999 was $44.00.[62] In real terms, the average value of a trade was substantially higher in earlier years.

Table 23 presents results for odd-lot sales minus odd-lot purchases as a percentage of NYSE trading volume by day of the week. For the period 1962-1986, the ratio is 0.58 percent while it is 0.47 percent Monday through Friday. For the period 1990-1999 the ratio for Monday is 0.068 percent and 0.062 percent for Monday through Friday. The statistic is 29 percent higher on Monday for the period 1962–1986 and only 8.8 percent higher in the 1990-1999 period. The difference for the 1962-1986 period is significantly different at the one percent level (t=4.87) while the difference for the most recent period 1990-1999 is not significantly different (t=1.32). In addition, the null hypothesis that the statistic is equal across all days of the week can be rejected at the significance level of one percent for the periods 1962-1986 and 1982-1986. However, for the period 1990-1999, you cannot reject the null hypothesis that the statistic is equal across all the days of the week. L&M point out that the statistic is positive suggesting individuals are net sellers of stock during the

[62] This information is provided at the www.nysedata.com internet site.

period 1962-1986. While the statistic is still positive during the period 1990-1999, it is important to note that odd-lot sales are biased by stock splits, stock dividends, dividend reinvestment plans and business combinations.[63] Individuals who start with a round-lot investment (an integer multiple of 100) may end up with an odd-lot fraction of shares because of the events mentioned above. In this case, the investor purchased a round-lot, but upon liquidation of their position, sells an odd-lot unit of shares. Thus, the level of odd-lot sales relative to odd-lot purchases is biased upwards as are the ratios reported in Table 23. The overall level of odd-lot sell transactions is also inflated by tax loss selling in the month of December, which is evident by an observed large increase in odd-lot sales relative to odd-lot purchases over the last ten trading days of December.

Table 24 and 25 describe the ratio of NYSE odd-lot purchases (sales) to NYSE trading volume. The results for both tables show the same patterns across the days of the week as Table 22—NYSE odd-lot sales plus purchases as a percentage of NYSE trading volume. Purchases (sales) are highest on Monday followed by Tuesday. The lowest level of purchases (sales) occurs on Thursday. Theses results support the argument that individual investors are most active on Monday and Tuesday and less active on Thursday. Studies by Warther (1995) and Goetzmann and Massa (2003) report the flow of funds into mutual funds has a direct impact on returns. Higher inflows correspond to higher returns and vice versa.

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[63] Odd-lot sales volume is inflated upwards relative to odd-lot purchases volume due to business combinations. "The Corporation (Kinross) has a large number of shareholders holding small numbers of common shares. The number of shareholders holding fewer than 100 Common Shares is estimated to be approximately 52,022 as of October 8, 2004, on which date such shareholders held an aggregate of approximately 1,699,225 Common Shares or approximately 0.49% of the total outstanding. Most of these small holdings resulted from previous business combinations including, for example, the combinations with TVX Gold Inc. and Echo Bay Mines Ltd." (Reference: News Release by Kinross Corporation 2004).

Table 23
NYSE Odd-Lot Sales Minus Odd-Lot Purchases as a Percentage of NYSE Trading Volume
Comparative Results with Lakonishok and Maberly (1990)

Source: Barron's Magazine for the Odd-Lot Purchases and Sales for 1990-1999. The *t*-statistic is testing the hypothesis that odd-lot sales minus odd-lot purchases divided by NYSE trading volume on the particular date is equal to the average across the other four trading days of the week. The *F*1-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week. The *F*2-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week, excluding Mondays.*

	Monday	Tuesday	Wednesday	Thursday	Friday	All Days	*F*1	*F*2
Period 1962-1986								
Mean	0.580	0.510	0.460	0.420	0.400	0.470	9.580 [a]	4.480 [a]
Median	0.480	0.450	0.420	0.390	0.380	0.420		
t-statistic	4.870 [a]	1.860	0.620	-2.500 [b]	-3.410 [a]			
Period 1982-1986								
Mean	0.280	0.250	0.220	0.210	0.230	0.240	36.480 [a]	8.660 [a]
Median	0.270	0.240	0.220	0.210	0.220	0.230		
t-statistic	10.020 [a]	1.850	-4.780 [a]	-5.220 [a]	-3.220 [a]			
Period1990-1999								
Mean	0.068	0.066	0.051	0.062	0.062	0.062	1.830	1.860
Median	0.075	0.069	0.059	0.063	0.065	0.066		
Std. Dev.	0.113	0.100	0.099	0.107	0.104	0.104		
t-statistic**	1.320	1.020	-2.590 [a]	-0.010	0.150			
n	481	520	516	508	503	2528		

* Log normal transformation not done as there are negative numbers in the numerator.
** t-test is a two sample test with an unequal variance assumption.
[a] Significant at the one percent level for a two-tailed test.
[b] Significant at the five percent level for a two tailed test.

Table 24
Ratio of NYSE Odd-Lot Sales to NYSE Trading Volume

Source: Barron's Magazine for the Odd-Lot Sales for 1990-1999. The *t*-statistic is testing the hypothesis that odd-lot sales divided by trading volume on the particular date is equal to the average across the other four trading days of the week. The *F*1-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week. The *F*2-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week, excluding Mondays.*

	Monday	Tuesday	Wednesday	Thursday	Friday	All Days	*F*1	*F*2
Period1990-1999								
Mean	0.464	0.456	0.434	0.431	0.439	0.444	13.850 [a]	7.150 [a]
Std. Dev.	0.088	0.107	0.090	0.097	0.100	0.097		
t-statistic**	6.200 [a]	2.940 [a]	-2.870 [a]	-3.820 [a]	-1.830			
n	482	519	516	508	503	2528		

*All statistical tests use the log normal transformation.

** t-test is a two sample test with an unequal variance assumption.

[a] Significant at the one percent level for a two-tailed test.

[b] Significant at the five percent level for a two tailed test.

Table 25
Ratio of NYSE Odd-Lot Purchases to NYSE Trading Volume

Source: Barron's Magazine for the Odd-Lot Purchases for 1990-1999. The *t*-statistic is testing the hypothesis that odd-lot purchases divided by trading volume on the particular date is equal to the average across the other four trading days of the week. The *F*1-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week. The *F*2-statistic is testing the hypothesis that the trading of individual investors is the same across all days of the week, excluding Mondays.

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**All Days**	***F*1**	***F*2**
Period1990-1999								
Mean	0.396	0.390	0.383	0.370	0.376	0.382	5.550 [a]	4.230 [a]
Std. Dev.	0.114	0.106	0.103	0.099	0.108	0.106		
t-statistic	3.070 [a]	2.070 [b]	0.050	-3.250 [a]	-1.840			
n	482	519	516	508	503	2528		

*All statistical tests use the log normal transformation.

** t-test is a two sample test with an unequal variance assumption.

[a] Significant at the one percent level for a two-tailed test.

[b] Significant at the five percent level for a two tailed test.

Thus, we might expect to observe a similar pattern in the flow of funds into mutual funds as that reported for the trading activity of individual investors. And, the highest flows into index funds should occur on Monday followed by Tuesday with the lowest flow reported for Thursday. In Table 26, the association between odd-lot transactions and DJIA returns across the days of the week is investigated. The ratio of odd-lot sales plus odd-lot purchases to NYSE trading volume is ranked by day of the week and similarly for odd-lot purchases to NYSE trading volume. The rankings are identical for both ratios and are as follows: (1) Monday, (2) Tuesday, (3) Wednesday, (4) Friday and (5) Thursday. A similar ranking is done for DJIA close-to-close returns across the days of the week. The Spearman rank correlation is computed at 0.90, which indicates a strong positive association between odd-lot transactions and returns across the days of the week. In addition, the correlation coefficient is calculated at 0.92. Both correlations are significant at the 5 percent level.

The unit of measurement for odd-lot transactions reported in Table 22 through 20 is millions of shares. To get a better idea of money flows, the dollar value of these transactions is examined and information is reported in Table 27 for the period 1962-1986, the sub-period 1982-1986 and for the period 1990-1999. The average price for odd-lot purchases (sales) is $42.11 ($41.77) over the period 1962-1986, and the ratio of the average sale price to the average purchase price equals 0.99. A ratio close to 1.00 implies that no adjustment is necessary when making inference about money flows based on an examination of odd-lot transaction data. The results reported in Table 22 through Table 25 are a good proxy for money flows across the days of the week, but not necessarily when making comparisons between periods.

In contrast, the average price for odd-lot purchases (sales) is $46.77 ($42.65) over the period 1990-1999, and the ratio of the average sales price to the average purchase price equals 0.91. A ratio below 1.00 implies that money flows associated with 1-share of odd-lot purchases are larger than those associated with 1-share of odd-lot sales, and this observation is important when interpreting the results reported in Table 23—odd-lot sales minus odd-lot purchases as a percentage of NYSE trading volume—for the period 1990-1999. After adjusting for the observation that 1-unit of odd-lot purchases represents \$46.77 versus \$42.65 for 1-unit of odd-lot sales, the positive coefficients reported in Table 23 for the period 1990-1999 change sign and all become negative. A negative coefficient in Table 23 implies that money flows are positive. Odd-lot transaction volume adjusted for average transaction price suggest money flows were, on average, negative over the period 1962-1986, but turn positive over period 1990-1999.

Table 26
Association Between Odd-lot Transactions and Returns

RANK	Ratio of Sales Plus Purchases/NYSE Trading Volume		Ratio of Odd-lot Purchases/NYSE Trading Volume		DJIA Close-to-Close Returns	
	Day of Week	Ratio	Day of Week	Ratio	Day of Week	Return
1	Monday	0.861	Monday	0.396	Monday	0.1556
2	Tuesday	0.847	Tuesday	0.390	Tuesday	0.0697
3	Wednesday	0.817	Wednesday	0.383	Friday	0.0497
4	Friday	0.815	Friday	0.376	Wednesday	0.0472
5	Thursday	0.801	Thursday	0.370	Thursday	-0.0385
Spearman Rank Correlation Coefficient[a]	0.90*		0.90*			
ρ	0.91*		0.92*			

[a] Spearman Rank Correlation Coefficient is a non-parametric testing for an association between concurrent returns and the ratios.
*Significant at the 5% level.

Table 27
Average Price Per Share: NYSE Odd-lot Transactions

1962-1986			1982-1986			1990-1999		
Year	Odd-lot Average Price Per Share Purchases	Odd-lot Average Price Per Share Sales	Year	Odd-lot Average Price Per Share Purchases	Odd-lot Average Price Per Share Sales	Year	Odd-lot Average Price Per Share Purchases	Odd-lot Average Price Per Share Sales
1962	$51.10	$50.24	1982	$29.87	$32.71	1990	$40.68	$37.29
1963	53.85	49.44	1983	40.01	38.89	1991	43.22	37.62
1964	54.37	49.23	1984	34.42	37.48	1992	44.91	40.02
1965	49.93	49.13	1985	37.75	39.67	1993	41.05	40.03
1966	52.80	52.78	1986	43.67	44.11	1994	39.31	37.72
1967	51.84	51.68				1995	44.23	39.42
1968	52.58	50.85				1996	47.58	44.09
1969	45.15	47.33				1997	53.81	48.85
1970	37.40	40.13				1998	56.32	51.02
1971	41.66	42.37				1999	56.62	50.48
1972	46.11	44.94						
1973	42.44	46.12						
1974	31.63	33.90						
1975	34.09	34.04						
1976	38.45	37.39						
1977	36.64	34.04						
1978	34.61	34.39						
1979	39.54	33.26						
1980	37.36	35.34						
1981	35.48	34.79						
1982	29.87	32.71						
1983	40.01	38.89						
1984	34.42	37.48						
1985	37.75	39.67						
1986	43.67	44.11						
Average	**$42.11**	**$41.77**	**Average**	**$37.14**	**$38.57**	**Average**	**$46.77**	**$42.65**
Ratio[a]		**0.9919**	**Ratio**		**1.0384**	**Ratio**		**0.9119**

[a] The ratio is sales average price/purchases average price.

Source: NYSE Fact Book (nysedata.com/factbook)

Chapter 5: Conclusions

Introduction

It is well documented in the academic literature that Monday's mean return for high-capitalized stocks is anomalous and statistically different from returns for the other days of the week. Prior to 1975, Monday's anomalous pattern is that the Friday close to Monday close return is negative with the bulk of the negative returns occurring from Monday's open to Monday's close—the Monday anomaly is a trading period effect prior to 1975. Thereafter, the pattern shifts and the anomalous pattern is that the Friday close to Monday open return is negative—the Monday anomaly is a weekend (non-trading) effect after 1974. These results are robust to the index used to measure stock returns for high-capitalized stocks like the DJIA, SP 500 index and CRSP value-weighted index. A true test of the seminal research findings on the Monday anomaly as reported by French (1980) and Smirlock and Starks (1986) plus explanations offered for this phenomenon by Lakonishok and Maberly (1990) is that past research conclusions carry over to an out of sample data set.

The decade of the 1990's marks one of the greatest bull market periods in history, which coincide with phenomenal growth in mutual fund assets but especially growth in index fund assets. If a well-defined change in market microstructure or a change in investor trading patterns is identified, then the prior research is testable.

Summary of the Findings

Strong evidence of major changes in market microstructure during the decade of the 1990's is identified through significant changes in cash flow patterns. Hale (1994) states the rapid growth in the early 1990's of mutual fund assets is creating a whole new financial system. During the 1990's, mutual fund assets grew at a 21.4

percent annual rate. The steep increase in mutual fund assets coincides with a steep rise in stock market indices like the DJIA or S&P 500 index. The 1990's mark a tremendous increase in both net assets and number of shareholder accounts in equity funds and purchases of common stock have increased 8.78 times. Prior to the 1990's, net purchases of stocks are predominately negative. The increased importance of index mutual funds has changed the timing of the flow of funds into the equity market and by conjecture return patterns.

Monday's return pattern has changed in the decade of the 1990's. There is a complete reversal in Monday's return pattern observed by French (1980) and Smirlock and Starks (1986) for the DJIA and SP 500 index. Not only is Monday's mean return significantly large and positive in the decade of the 1990's, but also the entire anomalous pattern occurs from Monday's open to Monday's close—an intraday effect. The day-of-the-week and Monday models confirm this intraday anomalous return pattern for Monday. The Monday daily mean return ratio for the DJIA, SP 500 index and the SP 500 index futures is large relative to other days of the week with the most startling observation being the ratio for the DJIA open-to-close returns at 58.7 indicating all of the returns accrue during the intraday period (94 percent of the total return accruing over the trading period).

In addition to the reversal of Monday's return pattern from that documented by prior studies, the mean returns for Thursday have reversed from positive to negative returns. The returns for Thursday for the DJIA, SP 500 index and SP 500 index futures on a close-to-open basis are positive. Therefore, one can rule out the release of negative information over the non-trading period as a cause. However, Thursday's return pattern is consistent with a flow of funds explanation, which suggest that the selling pressure that had been observed on Monday's has been transformed to Thursday. This emphasizes the dynamic nature of the time series patterns of stock prices and returns. This supports Maberly and Pierce's (2003) suggestion that anomalies are not robust over time and "familiarity with market microstructure issues in research is…as important as familiarity with esoteric econometric techniques." This partially explains the insightful commentary in a *Wall Street Journal* commentary by Richard Roll (principal of the portfolio management firm, Roll and Ross Asset Management):

If calendar time anomalies represent evidence of market inefficiencies, then they ought to represents an exploitable opportunity. I have personally tried to invest money, my client's and my own money, in every single anomaly and predictive result that academics have dreamed up. And I have yet to make a nickel on any of these supposed market inefficiencies. Real money investment strategies don't produce the results that academic papers say they should. If calendar time anomalies are evidence of market inefficiency, then there ought to be an exploitable opportunity.

In addition to the day-of-the-week and Monday linear models and to capture the significant autocorrelation in all of the squared returns, a ARMA-EGARCH model was utilized. The best fit model for the DJIA and SP 500 index futures was determined to be the ARMA (1,0)-EGARCH (1,1). However, the SP 500 index exhibited additional autocorrelation but this could be explained by the stale quote problem that exists in the SP 500 index. All of the series distributions had a negative skew and were highly leptokurtic. In addition, all series indicate impacts of the time-varying risk on their own returns implying the time-varying risk of all the series is important in explaining its own return. On a close-to-close basis, the model confirms Monday's returns are significantly positive for the DJIA, SP 500 index and SP 500 index futures. In addition, the results confirm those found using the ordinary linear regression model for open-to-close and are consistent with the anomaly being a day-of-the-week effect and not a weekend effect.

Analysis of the NYSE volume data by day of the week for the 1990-1999 period supports the conjecture by L&M (1990) that trading volume is a factor in explaining the anomalous behaviour of Monday's return. During the period 1962-1986, L&M's results indicate that trading volume is lowest on Monday relative to other days of the week. During the 1990-1999 period Monday's trading volume continues to be significantly lower from the trading volume of the other days of the week, but trading volume has increased by more than 370 percent since 1986. The increased overall volume but continued decreased trading activity on Monday is consistent with the increased importance of institutional investors in the market relative to individual investors. Analysis of trading activity by individual investors indicates that individual investors are most active in the market on Monday for all periods. Tuesday is the only other day where individual trading volume is above the weekly average. Individual investors continue to be least active on Thursdays. Consistent with the observation by L&M, odd-lot transactions have decreased dramatically over the time periods. Odd-lot transaction volume broken down into sales and purchases adjusted for average transaction price suggest money flows were, on average, negative over the period 1962-1986, but turn positive over the period 1990-1999.

Since the Monday anomaly occurs during the trading day, analysis on the time decomposed DJIA returns is completed to determine whether the effect is contained in the entire trading day or in some specific part of the day. The most striking results highlight the importance of differentiating a Monday trading period effect from a weekend effect. French (1980) coined the term weekend effect but in reality discovered a Monday trading period effect. Smirlock and Starks (1986) found the period from 1974 to 1983 indicated a non-trading period or weekend effect with Monday's opening returns being twice in absolute magnitude to any other day and significantly negative. In contrast, the 1968-1974 and 1990-1999 subperiods indicate the returns occur completely during the trading day (Monday trading period effect). Evidence from the hourly returns across days of the week suggests that there is a shift up in time in the patter of hourly returns on Monday. In all subperiods, Monday exhibits the largest returns in the first two trading hours. In the 1968-1974 period, the first two hours account for nearly all of the negative weekend effect for the entire trading period. On the other hand, the significant negative effects found in the first two hours of trading on Monday are consumed with significant positive trading over the rest of the Monday trading period. In 1990-1999, in addition to the significantly positive first two hours of trading, the last hour of trading contains significant return patterns on Monday that were not exhibited in prior subperiods. This is consistent with the trading strategies used by index fund managers who tend to transact near the end of the trading day. The return patters documented in this paper over 1990's are consistent with money flows being a significant contributing factor to seasonal patterns. Analysing the standard deviations of the hourly returns, which should be more reflective of information flows or noise, provides additional anecdotal evidence. Standard deviation is uniform across days of the week indicating that the differences in daily returns are not due to patterns in information flows.

General Discussion

The most important finding of this study is the observation that money flows are a significant explanatory variable for observed return patterns. This study provides additional anecdotal evidence that supports past research that money flows give rise to seasonal patterns in returns—like the January effect, turn-of-the-month effect and the Monday effect.

Second, a reasonable assumption is that the expected return is uniform across days of the week and is highly persistent across time. According to Ferson, Sarkissian, and Simin (2003), if expected equity returns are persistent, there is a risk of finding a spurious relationship between the return and an independent, highly correlated lag variable. So spurious regression is of serious concern to financial economists when conducting day-of-the-week studies. Day-of-the-week studies are a form of data mining where the results in the regressions produce apparent variables with significant explanatory variables by chance. In this case, we would expect instruments (like day-of-the-week return patterns) to arise but then fails to be confirmed out of sample. Then a new instrument (day-of-the-week patterns) arises and again fails to be confirmed out of sample. In the context of this study, prior day-of-the-week observed patterns are not confirmed out of sample—the out of sample period being the decade of the 1990's.

The model suggested by Ferson et al. has equity returns equal to the expected return plus a random return due to the influence of unpredictable noise. You can think of the unpredictable noise as the effect of money flows on returns. Furthermore, there is a problem in predictability in model selection because of spurious correlation of the instrument variables on returns. In other words, you construct a model that gives you a significant day-of-the-week pattern, but when you select a new data set, a different pattern emerges. This emphasizes the dynamic nature of seasonal return patterns. It is the instrument variables (i.e., money flows across the days of the week) themselves that are dynamic and unpredictable. Within this context, seasonal patterns in returns are not necessarily a violation of the efficient market hypothesis.

Suggestions for Further Research

If money flow patterns are relevant to the determination of equity returns, then such information is valuable to market participants. However, high frequency money flow data is difficult to obtain and only becomes publicly available after a time lag, and then the available information is usually only a proxy for money flows. However, there are specific market participants like the managers of mutual fund families who know the money flows for their funds on a real time basis. There is the potential to use this information to "front-run" the trading decisions of others—in particular the trading decisions of index fund managers who tend to trade near the close of the day. Money flow information might explain unusual trading patterns in S&P 500 futures, broad based index options and Exchange Traded Funds like the Spiders (S&P 500) or Diamonds (DJIA). Although not a part of this study, I examined the return patterns of Spiders and found evidence of front running by institutional investors using proprietary money flows data. Spiders began trading in 1994, and overnight returns (close-open) display an unusual pattern. All of the return to the Spiders over the period 1994-1999 occurs during the non-trading period. The trading period return for the Spiders over the period 1994-1999 is approximately zero.

In addition, this research reinforces the need for additional discussion in the academic community of both the implications and intentions that apply to the efficient market paradigm. Does the existence of statistically significant anomalous behaviour in itself refute the EMH? I have not found where it says that patterns cannot exist but rather the theory contends exploitable patterns do not exist. If this is the case, then economic significance becomes more important than statistical significance in relation to the research we do and the implications we can make about EMH. Jensen (1978) highlighted the extreme importance of trading profitability when assessing market efficiency. If the behaviour is not strong enough to outperform a buy and hold strategy on a risk-adjusted basis, then it is not economically significant.

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Appendix 1: Returns – Descriptive Analysis

All Days

Dow Jones Industrial Average

With all Days

ALL DAYS - WITH ALL DAYS							
DJIA C-C		*DJIA C-O*		*DJIA O-C*		*DJIA O-O*	
Mean	0.0558	Mean	0.0242	Mean	0.0315	Mean	0.0565
Standard Error	0.0177	Standard Error	0.0097	Standard Error	0.0158	Standard Error	0.0195
Median	0.0601	Median	0.0317	Median	0.0388	Median	0.0745
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8906	Standard Deviation	0.4883	Standard Deviation	0.7937	Standard Deviation	0.9803
Sample Variance	0.7931	Sample Variance	0.2384	Sample Variance	0.6299	Sample Variance	0.9610
Kurtosis	5.1973	Kurtosis	11.2038	Kurtosis	7.7881	Kurtosis	7.1445
Skewness	-0.3993	Skewness	-0.5152	Skewness	-0.3039	Skewness	-0.4662
Range	12.3154	Range	8.1500	Range	13.8707	Range	16.2924
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-9.2698
Maximum	4.8605	Maximum	4.1615	Maximum	6.8656	Maximum	7.0226
Sum	140.8859	Sum	61.2207	Sum	79.6652	Sum	142.6932
Count	2527	Count	2527	Count	2527	Count	2527
Largest(1)	4.8605	Largest(1)	4.1615	Largest(1)	6.8656	Largest(1)	7.0226
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-9.2698
Confidence Level(95.0 %)	0.0347	Confidence Level(95.0 %)	0.0190	Confidence Level(95.0 %)	0.0310	Confidence Level(95.0 %)	0.0382

Without January

WITHOUT JANUARY							
Mean	0.0537	Mean	0.0278	Mean	0.0259	Mean	0.0558
Standard Error	0.0184	Standard Error	0.0099	Standard Error	0.0164	Standard Error	0.0202
Median	0.0538	Median	0.0329	Median	0.0349	Median	0.0750
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8867	Standard Deviation	0.4787	Standard Deviation	0.7876	Standard Deviation	0.9704
Sample Variance	0.7863	Sample Variance	0.2292	Sample Variance	0.6203	Sample Variance	0.9417
Kurtosis	5.4761	Kurtosis	11.0154	Kurtosis	8.5851	Kurtosis	7.5774
Skewness	-0.4459	Skewness	-0.5626	Skewness	-0.3131	Skewness	-0.4915
Range	12.3154	Range	8.1500	Range	13.8707	Range	16.2924
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-9.2698
Maximum	4.8605	Maximum	4.1615	Maximum	6.8656	Maximum	7.0226
Sum	124.4832	Sum	64.4060	Sum	60.0771	Sum	129.3014
Count	2317	Count	2317	Count	2317	Count	2317
Largest(1)	4.8605	Largest(1)	4.1615	Largest(1)	6.8656	Largest(1)	7.0226
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-9.2698
Confidence Level(95.0 %)	0.0361	Confidence Level(95.0 %)	0.0195	Confidence Level(95.0 %)	0.0321	Confidence Level(95.0 %)	0.0395

Without Pre/Post Holidays

WITHOUT PRE/POST HOLIDAY							
DJIA Close-to-Close		*DJIA Close-to-Open*		*(Intraday)*		*DJIA Open-to-open*	
Mean	0.0536	Mean	0.0226	Mean	0.0310	Mean	0.0617
Standard Error	0.0183	Standard Error	0.0099	Standard Error	0.0164	Standard Error	0.0203
Median	0.0557	Median	0.0307	Median	0.0378	Median	0.0811
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8853	Standard Deviation	0.4817	Standard Deviation	0.7951	Standard Deviation	0.9847
Sample Variance	0.7837	Sample Variance	0.2320	Sample Variance	0.6322	Sample Variance	0.9696
Kurtosis	5.3240	Kurtosis	10.2446	Kurtosis	8.2224	Kurtosis	7.4757
Skewness	-0.5052	Skewness	-0.7651	Skewness	-0.3321	Skewness	-0.5078
Range	12.0557	Range	7.6213	Range	13.8707	Range	16.2924
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-9.2698
Maximum	4.6008	Maximum	3.6328	Maximum	6.8656	Maximum	7.0226
Sum	126.0141	Sum	53.0160	Sum	72.9981	Sum	145.0806
Count	2351	Count	2351	Count	2351	Count	2351
Largest(1)	4.6008	Largest(1)	3.6328	Largest(1)	6.8656	Largest(1)	7.0226
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-9.2698
Confidence Level(95.0 %)	0.0358	Confidence Level(95.0 %)	0.0195	Confidence Level(95.0 %)	0.0322	Confidence Level(95.0 %)	0.0398

Without January and Pre/Post Holidays

WITHOUT JAN & PRE/POST HOLIDAY							
Mean	0.0539	Mean	0.0276	Mean	0.0263	Mean	0.0607
Standard Error	0.0190	Standard Error	0.0101	Standard Error	0.0170	Standard Error	0.0210
Median	0.0525	Median	0.0326	Median	0.0324	Median	0.0782
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8808	Standard Deviation	0.4707	Standard Deviation	0.7885	Standard Deviation	0.9740
Sample Variance	0.7757	Sample Variance	0.2215	Sample Variance	0.6217	Sample Variance	0.9487
Kurtosis	5.6215	Kurtosis	9.7306	Kurtosis	9.0944	Kurtosis	7.9594
Skewness	-0.5628	Skewness	-0.8568	Skewness	-0.3417	Skewness	-0.5327
Range	12.0557	Range	7.4270	Range	13.8707	Range	16.2924
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-9.2698
Maximum	4.6008	Maximum	3.4385	Maximum	6.8656	Maximum	7.0226
Sum	116.0676	Sum	59.4595	Sum	56.6081	Sum	130.6510
Count	2154	Count	2154	Count	2154	Count	2154
Largest(1)	4.6008	Largest(1)	3.4385	Largest(1)	6.8656	Largest(1)	7.0226
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-9.2698
Confidence Level(95.0%)	0.0372	Confidence Level(95.0%)	0.0199	Confidence Level(95.0%)	0.0333	Confidence Level(95.0%)	0.0412

SP 500 and SP 500 Futures

With all days

SP 500 - Close-Close		*SPF Close-to-*		*SPF Close-to-Open*		*SPF Open-to-*		*SPF Open-to-open*	
Mean	0.0557	Mean	0.0436	Mean	0.0129	Mean	0.0306	Mean	0.0443
Standard		Standard		Standard		Standard		Standard	
Error	0.0177	Error	0.019	Error	0.0087	Error	0.0171	Error	0.0196
Median	0.0537	Median	0.051	Median	0.0192	Median	0.0463	Median	0.0662
Mode	0	Mode	0	Mode	0	Mode	0	Mode	0
Standard		Standard		Standard		Standard		Standard	
Deviation	0.892	Deviation	0.9544	Deviation	0.4356	Deviation	0.8616	Deviation	0.9872
Sample		Sample		Sample		Sample		Sample	
Variance	0.7956	Variance	0.9108	Variance	0.1897	Variance	0.7423	Variance	0.9745
Kurtosis	5.2817	Kurtosis	6.1687	Kurtosis	11.744	Kurtosis	8.8952	Kurtosis	7.5589
Skewness	-0.368	Skewness	-0.378	Skewness	-0.652	Skewness	-0.361	Skewness	-0.398
Range	12.101	Range	13.379	Range	7.5135	Range	15.594	Range	16.283
Minimum	-7.113	Minimum	-7.762	Minimum	-3.857	Minimum	-8.246	Minimum	-8.665
Maximum	4.9887	Maximum	5.6173	Maximum	3.657	Maximum	7.3484	Maximum	7.6185
Sum	140.73	Sum	110.15	Sum	32.709	Sum	77.438	Sum	112.01
Count	2527	Count	2527	Count	2527	Count	2527	Count	2526
Largest(1)	4.9887	Largest(1)	5.6173	Largest(1)	3.657	Largest(1)	7.3484	Largest(1)	7.6185
Smallest(1)	-7.113	Smallest(1)	-7.762	Smallest(1)	-3.857	Smallest(1)	-8.246	Smallest(1)	-8.665
Confidence		Confidence		Confidence		Confidence		Confidence	
Level(95.0%)	0.0348	Level(95.0%)	0.0372	Level(95.0%)	0.017	Level(95.0%)	0.0336	Level(95.0%)	0.0385

Without January

SP 500 Close-Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*SPF Open-to-Close(Intraday)*		*SPF Open-to-open*	
Mean	0.0005	Mean	0.0430	Mean	0.0115	Mean	0.0315	Mean	0.0454
Standard		Standard		Standard		Standard		Standard	
Error	0.0002	Error	0.0198	Error	0.0089	Error	0.0179	Error	0.0204
Median	0.0006	Median	0.0530	Median	0.0174	Median	0.0481	Median	0.0662
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard		Standard		Standard		Standard		Standard	
Deviation	0.0089	Deviation	0.9544	Deviation	0.4306	Deviation	0.8598	Deviation	0.9797
Sample		Sample		Sample		Sample		Sample	
Variance	0.0001	Variance	0.9109	Variance	0.1854	Variance	0.7393	Variance	0.9598
Kurtosis	5.5691	Kurtosis	6.4710	Kurtosis	10.9779	Kurtosis	9.6003	Kurtosis	7.9898
Skewness	-0.3988	Skewness	-0.3868	Skewness	-0.8948	Skewness	-0.3538	Skewness	-0.4465
Range	0.1210	Range	13.3793	Range	6.6914	Range	15.5943	Range	16.2832
Minimum	-0.0711	Minimum	-7.7621	Minimum	-3.8565	Minimum	-8.2459	Minimum	-8.6648
Maximum	0.0499	Maximum	5.6173	Maximum	2.8348	Maximum	7.3484	Maximum	7.6185
Sum	1.2707	Sum	99.5395	Sum	26.5337	Sum	73.0058	Sum	105.1272
Count	2317	Count	2317	Count	2317	Count	2317	Count	2316
Largest(1)	0.0499	Largest(1)	5.6173	Largest(1)	2.8348	Largest(1)	7.3484	Largest(1)	7.6185
Smallest(1)	-0.0711	Smallest(1)	-7.7621	Smallest(1)	-3.8565	Smallest(1)	-8.2459	Smallest(1)	-8.6648
Confidence		Confidence		Confidence		Confidence		Confidence	
Level(95.0%	0.0004	Level(95.0%	0.0389	Level(95.0%	0.0175	Level(95.0%	0.0350	Level(95.0%	0.0399

Without Pre/Post Holidays

S&P 500 Close-to-		***SPF***	***Close-to-Close***	***SPF***	***Close-to-Open***	***SPF Open-to-***		***SPF***	***Open-to-open***
Mean	0.0006	Mean	0.0369	Mean	0.0226	Mean	0.0143	Mean	0.0154
Standard		Standard		Standard		Standard		Standard	
Error	0.0004	Error	0.0454	Error	0.0237	Error	0.0400	Error	0.0481
Median	0.0008	Median	0.0592	Median	0.0401	Median	0.0678	Median	0.0821
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard		Standard		Standard		Standard		Standard	
Deviation	0.0089	Deviation	0.9623	Deviation	0.5030	Deviation	0.8476	Deviation	1.0194
Sample		Sample		Sample		Sample		Sample	
Variance	0.0001	Variance	0.9260	Variance	0.2530	Variance	0.7185	Variance	1.0391
Kurtosis	1.8179	Kurtosis	2.3689	Kurtosis	3.8398	Kurtosis	2.8210	Kurtosis	2.7168
Skewness	-0.3989	Skewness	-0.3075	Skewness	-0.5041	Skewness	-0.1817	Skewness	-0.0457
Range	0.0663	Range	8.0950	Range	4.0463	Range	7.7500	Range	9.6019
Minimum	-0.0373	Minimum	-3.6987	Minimum	-1.9461	Minimum	-3.7615	Minimum	-4.3063
Maximum	0.0290	Maximum	4.3963	Maximum	2.1002	Maximum	3.9886	Maximum	5.2956
Sum	0.2628	Sum	16.6215	Sum	10.1870	Sum	6.4345	Sum	6.9050
Count	450	Count	450	Count	450	Count	450	Count	449
Largest(1)	0.0290	Largest(1)	4.3963	Largest(1)	2.1002	Largest(1)	3.9886	Largest(1)	5.2956
Smallest(1)	-0.0373	Smallest(1)	-3.6987	Smallest(1)	-1.9461	Smallest(1)	-3.7615	Smallest(1)	-4.3063
Confidence		Confidence		Confidence		Confidence		Confidence	
Level(95.0%	0.0008	Level(95.0%	0.0891	Level(95.0%	0.0466	Level(95.0%	0.0785	Level(95.0%	0.0945

Without January and Pre/Post Holidays

S&P 500 Close-to-		*SPF*	*Close-to-Close*	*SPF*	*Close-to-Open*	*SPF Open-to-*		*SPF*	*Open-to-open*
Mean	0.0006	Mean	0.0455	Mean	0.0105	Mean	0.0350	Mean	0.0516
Standard		Standard		Standard		Standard		Standard	
Error	0.0002	Error	0.0204	Error	0.0092	Error	0.0185	Error	0.0213
Median	0.0006	Median	0.0546	Median	0.0136	Median	0.0532	Median	0.0720
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard		Standard		Standard		Standard		Standard	
Deviation	0.0088	Deviation	0.9471	Deviation	0.4260	Deviation	0.8578	Deviation	0.9881
Sample		Sample		Sample		Sample		Sample	
Variance	0.0001	Variance	0.8970	Variance	0.1815	Variance	0.7358	Variance	0.9763
Kurtosis	5.7499	Kurtosis	6.7382	Kurtosis	11.3439	Kurtosis	10.2513	Kurtosis	8.2500
Skewness	-0.4913	Skewness	-0.4998	Skewness	-1.0148	Skewness	-0.3968	Skewness	-0.4660
Range	0.1210	Range	13.3793	Range	6.6914	Range	15.5943	Range	16.2832
Minimum	-0.0711	Minimum	-7.7621	Minimum	-3.8565	Minimum	-8.2459	Minimum	-8.6648
Maximum	0.0499	Maximum	5.6173	Maximum	2.8348	Maximum	7.3484	Maximum	7.6185
Sum	1.2680	Sum	98.0035	Sum	22.5170	Sum	75.4865	Sum	111.1443
Count	2154	Count	2154	Count	2154	Count	2154	Count	2153
Largest(1)	0.0499	Largest(1)	5.6173	Largest(1)	2.8348	Largest(1)	7.3484	Largest(1)	7.6185
Smallest(1)	-0.0711	Smallest(1)	-7.7621	Smallest(1)	-3.8565	Smallest(1)	-8.2459	Smallest(1)	-8.6648
Confidence		Confidence		Confidence		Confidence		Confidence	
Level(95.0%	0.0004	Level(95.0%	0.0400	Level(95.0%	0.0180	Level(95.0%	0.0362	Level(95.0%	0.0418

Monday

Dow Jones Industrial Average

With all Days

DJIA Close-to-Close		*DJIA Close-to-Open*		*DJIA Open-to-Close (Intraday)*		*DJIA Open-to-open*	
Mean	0.1556	Mean	-0.0030	Mean	0.1585	Mean	-0.0144
Standard Error	0.0450	Standard Error	0.0249	Standard Error	0.0403	Error	0.0479
Median	0.1625	Median	0.0093	Median	0.1429	Median	0.0165
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.9890	Standard Deviation	0.5474	Standard Deviation	0.8840	Standard Deviation	1.0513
Variance	0.9782	Sample Variance	0.2996	Sample Variance	0.7814	Variance	1.1052
Kurtosis	11.9386	Kurtosis	13.9694	Kurtosis	17.3851	Kurtosis	3.5926
Skewness	-1.6940	Skewness	-1.0779	Skewness	-2.0056	Skewness	-0.3448
Range	10.5287	Range	7.4270	Range	10.1231	Range	9.6182
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-5.0752
Maximum	3.0738	Maximum	3.4385	Maximum	3.1180	Maximum	4.5430
Sum	74.9827	Sum	-1.4265	Sum	76.4092	Sum	-6.9294
Count	482	Count	482	Count	482	Count	482
Largest(1)	3.0738	Largest(1)	3.4385	Largest(1)	3.1180	Largest(1)	4.5430
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-5.0752
Confidence Level(95.0%)	0.0885	Confidence Level(95.0%)	0.0490	Confidence Level(95.0%)	0.0791	Confidence Level(95.0%)	0.0941

Without January

DJIA Close-to-Close		*DJIA Close-to-Open*		*DJIA Open-to-Close (Intraday)*		*DJIA Open-to-open*	
Mean	0.1696	Mean	0.0095	Mean	0.1601	Mean	-0.0121
Standard Error	0.0478	Standard Error	0.0260	Standard Error	0.0423	Standard Error	0.0495
Median	0.1754	Median	0.0154	Median	0.1472	Median	0.0160
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Deviation	1.0067	Deviation	0.5474	Deviation	0.8912	Deviation	1.0425
Sample Variance	1.0134	Sample Variance	0.2997	Sample Variance	0.7943	Sample Variance	1.0869
Kurtosis	12.0132	Kurtosis	14.8071	Kurtosis	17.9791	Kurtosis	3.2567
Skewness	-1.7108	Skewness	-1.0211	Skewness	-2.1378	Skewness	-0.2134
Range	10.5287	Range	7.4270	Range	10.1231	Range	9.6182
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-5.0752
Maximum	3.0738	Maximum	3.4385	Maximum	3.1180	Maximum	4.5430
Sum	75.1325	Sum	4.1978	Sum	70.9348	Sum	-5.3526
Count	443	Count	443	Count	443	Count	443
Largest(1)	3.0738	Largest(1)	3.4385	Largest(1)	3.1180	Largest(1)	4.5430
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-5.0752
Confidence Level(95.0%)	0.0940	Confidence Level(95.0%)	0.0511	Confidence Level(95.0%)	0.0832	Confidence Level(95.0%)	0.0973

Without Pre/Post Holidays

DJIA Close-to-Close		*DJIA Close-to-Open*		*DJIA Open-to-Close (Intraday)*		*DJIA Open-to-open*	
Mean	0.1610	Mean	0.0019	Mean	0.1590	Mean	-0.0036
Standard Error	0.0468	Standard Error	0.0252	Standard Error	0.0418	Standard Error	0.0501
Median	0.1605	Median	0.0093	Median	0.1429	Median	0.0176
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.9875	Standard Deviation	0.5328	Standard Deviation	0.8827	Standard Deviation	1.0585
Sample Variance	0.9751	Sample Variance	0.2839	Sample Variance	0.7791	Sample Variance	1.1205
Kurtosis	12.9820	Kurtosis	16.0826	Kurtosis	18.8822	Kurtosis	3.7355
Skewness	-1.8058	Skewness	-1.0145	Skewness	-2.1867	Skewness	-0.3211
Range	10.5287	Range	7.4270	Range	10.1231	Range	9.6182
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-5.0752
Maximum	3.0738	Maximum	3.4385	Maximum	3.1180	Maximum	4.5430
Sum	71.8002	Sum	0.8666	Sum	70.9335	Sum	-1.6081
Count	446	Count	446	Count	446	Count	446
Largest(1)	3.0738	Largest(1)	3.4385	Largest(1)	3.1180	Largest(1)	4.5430
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-5.0752
Confidence Level(95.0%)	0.0919	Confidence Level(95.0%)	0.0496	Confidence Level(95.0%)	0.0821	Confidence Level(95.0%)	0.0985

Without January and Pre/Post Holidays

Mean	0.1766	Mean	0.0183	Mean	0.1583	Mean	-0.0004
Standard Error	0.0495	Standard Error	0.0262	Standard Error	0.0438	Standard Error	0.0517
Median	0.1734	Median	0.0200	Median	0.1375	Median	0.0161
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	1.0028	Standard Deviation	0.5301	Standard Deviation	0.8877	Standard Deviation	1.0473
Sample Variance	1.0056	Sample Variance	0.2810	Sample Variance	0.7881	Sample Variance	1.0968
Kurtosis	13.2131	Kurtosis	17.3902	Kurtosis	19.7112	Kurtosis	3.4090
Skewness	-1.8353	Skewness	-0.9474	Skewness	-2.3400	Skewness	-0.1759
Range	10.5287	Range	7.4270	Range	10.1231	Range	9.6182
Minimum	-7.4549	Minimum	-3.9885	Minimum	-7.0051	Minimum	-5.0752
Maximum	3.0738	Maximum	3.4385	Maximum	3.1180	Maximum	4.5430
Sum	72.4012	Sum	7.4849	Sum	64.9164	Sum	-0.1833
Count	410	Count	410	Count	410	Count	410
Largest(1)	3.0738	Largest(1)	3.4385	Largest(1)	3.1180	Largest(1)	4.5430
Smallest(1)	-7.4549	Smallest(1)	-3.9885	Smallest(1)	-7.0051	Smallest(1)	-5.0752
Confidence Level(95.0%)	0.0974	Confidence Level(95.0%)	0.0515	Confidence Level(95.0%)	0.0862	Confidence Level(95.0%)	0.1017

SP 500 and SP 500 Futures

With all days

S&P 500 Close-to-Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*SPF Open-to-Close(Intraday)*		*SPF Open-to-open*	
Mean	0.0011	Mean	0.0013	Mean	0.0003	Mean	0.0010	Mean	0.0013
Standard Error	0.0004	Standard Error	0.0005	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0013	Median	0.0014	Median	0.0003	Median	0.0010	Median	0.0017
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0098	Standard Deviation	0.0106	Standard Deviation	0.0048	Standard Deviation	0.0094	Standard Deviation	0.0097
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	12.1169	Kurtosis	12.9075	Kurtosis	11.7703	Kurtosis	19.0778	Kurtosis	18.0544
Skewness	-1.6970	Skewness	-1.7341	Skewness	-0.6126	Skewness	-2.2484	Skewness	-1.9386
Range	0.1025	Range	0.1144	Range	0.0636	Range	0.1106	Range	0.1248
Minimum	-0.0711	Minimum	-0.0776	Minimum	-0.0352	Minimum	-0.0825	Minimum	-0.0866
Maximum	0.0314	Maximum	0.0368	Maximum	0.0283	Maximum	0.0282	Maximum	0.0381
Sum	0.5482	Sum	0.6408	Sum	0.1656	Sum	0.4753	Sum	0.6222
Count	482	Count	482	Count	482	Count	482	Count	482
Largest(1)	0.0314	Largest(1)	0.0368	Largest(1)	0.0283	Largest(1)	0.0282	Largest(1)	0.0381
Smallest(1)	-0.0711	Smallest(1)	-0.0776	Smallest(1)	-0.0352	Smallest(1)	-0.0825	Smallest(1)	-0.0866
Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0009	Confidence Level(95.0 %)	0.0004	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Without January

S&P 500 Close-to-Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*SPF Open-to-Close(Intraday)*		*SPF Open-to-open*	
Mean	0.0013	Mean	0.0015	Mean	0.0004	Mean	0.0011	Mean	0.0014
Standard Error	0.0005	Standard Error	0.0005	Standard Error	0.0002	Standard Error	0.0005	Standard Error	0.0005
Median	0.0017	Median	0.0017	Median	0.0004	Median	0.0013	Median	0.0017
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Deviation	0.0100	Deviation	0.0108	Deviation	0.0049	Deviation	0.0095	Deviation	0.0098
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	12.2664	Kurtosis	13.0605	Kurtosis	11.9047	Kurtosis	19.8535	Kurtosis	19.0464
Skewness	-1.7423	Skewness	-1.7721	Skewness	-0.6085	Skewness	-2.3769	Skewness	-2.1248
Range	0.1025	Range	0.1144	Range	0.0636	Range	0.1106	Range	0.1248
Minimum	-0.0711	Minimum	-0.0776	Minimum	-0.0352	Minimum	-0.0825	Minimum	-0.0866
Maximum	0.0314	Maximum	0.0368	Maximum	0.0283	Maximum	0.0281	Maximum	0.0381
Sum	0.5884	Sum	0.6780	Sum	0.1966	Sum	0.4813	Sum	0.6138
Count	443	Count	443	Count	443	Count	443	Count	443
Largest(1)	0.0314	Largest(1)	0.0368	Largest(1)	0.0283	Largest(1)	0.0281	Largest(1)	0.0381
Smallest(1)	-0.0711	Smallest(1)	-0.0776	Smallest(1)	-0.0352	Smallest(1)	-0.0825	Smallest(1)	-0.0866
Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0010	Confidence Level(95.0%)	0.0005	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0009

Without Pre/Post Holidays

S&P 500 Close-to-Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*SPF Open-to-Close(Intraday)*		*SPF Open-to-open*	
Mean	0.0012	Mean	0.0014	Mean	0.0003	Mean	0.0011	Mean	0.0014
Standard Error	0.0005	Standard Error	0.0005	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0005
Median	0.0014	Median	0.0015	Median	0.0002	Median	0.0013	Median	0.0017
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0097	Standard Deviation	0.0104	Standard Deviation	0.0047	Standard Deviation	0.0093	Standard Deviation	0.0097
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	13.6369	Kurtosis	15.0697	Kurtosis	13.4175	Kurtosis	21.6891	Kurtosis	19.8744
Skewness	-1.8595	Skewness	-2.0514	Skewness	-0.6584	Skewness	-2.5570	Skewness	-2.1439
Range	0.1025	Range	0.1144	Range	0.0636	Range	0.1106	Range	0.1248
Minimum	-0.0711	Minimum	-0.0776	Minimum	-0.0352	Minimum	-0.0825	Minimum	-0.0866
Maximum	0.0314	Maximum	0.0368	Maximum	0.0283	Maximum	0.0282	Maximum	0.0381
Sum	0.5446	Sum	0.6385	Sum	0.1539	Sum	0.4846	Sum	0.6228
Count	446.0000	Count	446.0000	Count	446.0000	Count	446.0000	Count	446.0000
Largest(1)	0.0314	Largest(1)	0.0368	Largest(1)	0.0283	Largest(1)	0.0282	Largest(1)	0.0381
Smallest(1)	-0.0711	Smallest(1)	-0.0776	Smallest(1)	-0.0352	Smallest(1)	-0.0825	Smallest(1)	-0.0866
Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0010	Confidence Level(95.0%)	0.0004	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0009

Without January and Pre/Post Holidays

Mean	0.00143	Mean	0.00163	Mean	0.00046	Mean	0.00117	Mean	0.00145
Standard Error	0.00049	Standard Error	0.00052	Standard Error	0.00023	Standard Error	0.00046	Standard Error	0.00048
Median	0.00169	Median	0.00176	Median	0.00033	Median	0.00135	Median	0.00176
Mode	#N/A	Mode	0	Mode	0	Mode	0	Mode	0
Standard Deviation	0.00984	Standard Deviation	0.01051	Standard Deviation	0.00474	Standard Deviation	0.00938	Standard Deviation	0.00976
Sample Variance	9.7E-05	Sample Variance	0.00011	Sample Variance	2.2E-05	Sample Variance	8.8E-05	Sample Variance	9.5E-05
Kurtosis	13.9858	Kurtosis	15.4441	Kurtosis	13.7922	Kurtosis	22.8094	Kurtosis	21.0324
Skewness	-1.9212	Skewness	-2.10591	Skewness	-0.6591	Skewness	-2.71561	Skewness	-2.34382
Range	0.10251	Range	0.11442	Range	0.06358	Range	0.11028	Range	0.12476
Minimum	-0.07113	Minimum	-0.07762	Minimum	-0.03523	Minimum	-0.08246	Minimum	-0.08665
Maximum	0.03138	Maximum	0.0368	Maximum	0.02835	Maximum	0.02782	Maximum	0.03811
Sum	0.58516	Sum	0.66927	Sum	0.18889	Sum	0.48038	Sum	0.59562
Count	410	Count	410	Count	410	Count	410	Count	410
Largest(1)	0.03138	Largest(1)	0.0368	Largest(1)	0.02835	Largest(1)	0.02782	Largest(1)	0.03811
Smallest(1)	-0.07113	Smallest(1)	-0.07762	Smallest(1)	-0.03523	Smallest(1)	-0.08246	Smallest(1)	-0.08665
Confidence Level(95.0%)	0.00096	Confidence Level(95.0%)	0.00102	Confidence Level(95.0%)	0.00046	Confidence Level(95.0%)	0.00091	Confidence Level(95.0%)	0.00095

Tuesday

Dow Jones Industrial Average

With all days

DJIA Close-to-Close		*DJIA Close-to-Open*		*(Intraday)*		*DJIA Open-to-open*	
Mean	0.0697	Mean	0.0427	Mean	0.0269	Mean	0.1876
Standard Error	0.0390	Standard Error	0.0197	Standard Error	0.0356	Standard Error	0.0435
Median	0.0175	Median	0.0341	Median	-0.0082	Median	0.2050
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8868	Standard Deviation	0.4474	Standard Deviation	0.8099	Standard Deviation	0.9907
Sample Variance	0.7864	Sample Variance	0.2002	Sample Variance	0.6560	Sample Variance	0.9814
Kurtosis	3.7086	Kurtosis	16.3905	Kurtosis	9.8473	Kurtosis	19.4296
Skewness	0.6462	Skewness	1.1718	Skewness	1.2571	Skewness	-2.0208
Range	8.0089	Range	6.4263	Range	9.1080	Range	12.7712
Minimum	-3.1484	Minimum	-2.2648	Minimum	-2.2424	Minimum	-9.2698
Maximum	4.8605	Maximum	4.1615	Maximum	6.8656	Maximum	3.5014
Sum	36.0947	Sum	22.1396	Sum	13.9551	Sum	97.1749
Count	518.0000	Count	518.0000	Count	518.0000	Count	518.0000
Largest(1)	4.8605	Largest(1)	4.1615	Largest(1)	6.8656	Largest(1)	3.5014
Smallest(1)	-3.1484	Smallest(1)	-2.2648	Smallest(1)	-2.2424	Smallest(1)	-9.2698
Confidence Level(95.0%)	0.0765	Confidence Level(95.0%)	0.0386	Confidence Level(95.0%)	0.0699	Confidence Level(95.0%)	0.0855

Without January

Mean	0.0572	Mean	0.0428	Mean	0.0145	Mean	0.1873
Standard Error	0.0409	Standard Error	0.0206	Standard Error	0.0369	Standard Error	0.0459
Median	0.0032	Median	0.0338	Median	-0.0085	Median	0.2085
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8916	Standard Deviation	0.4503	Standard Deviation	0.8048	Standard Deviation	1.0005
Sample Variance	0.7949	Sample Variance	0.2028	Sample Variance	0.6477	Sample Variance	1.0011
Kurtosis	4.0359	Kurtosis	17.3110	Kurtosis	11.1636	Kurtosis	20.1147
Skewness	0.7026	Skewness	1.2252	Skewness	1.3868	Skewness	-2.1984
Range	8.0089	Range	6.4263	Range	9.1080	Range	12.6762
Minimum	-3.1484	Minimum	-2.2648	Minimum	-2.2424	Minimum	-9.2698
Maximum	4.8605	Maximum	4.1615	Maximum	6.8656	Maximum	3.4064
Sum	27.2476	Sum	20.3589	Sum	6.8887	Sum	89.1384
Count	476.0000	Count	476.0000	Count	476.0000	Count	476.0000
Largest(1)	4.8605	Largest(1)	4.1615	Largest(1)	6.8656	Largest(1)	3.4064
Smallest(1)	-3.1484	Smallest(1)	-2.2648	Smallest(1)	-2.2424	Smallest(1)	-9.2698
Confidence Level(95.0%)	0.0803	Confidence Level(95.0%)	0.0406	Confidence Level(95.0%)	0.0725	Confidence Level(95.0%)	0.0901

Without Pre/Post Holidays

DJIA Close-to-Close		*DJIA Close-to-Open*		*(Intraday)*		*DJIA Open-to-open*	
Mean	0.0568	Mean	0.0378	Mean	0.0190	Mean	0.1835
Standard Error	0.0390	Standard Error	0.0188	Standard Error	0.0366	Standard Error	0.0453
Median	0.0000	Median	0.0338	Median	-0.0346	Median	0.2076
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviati	0.8480	Standard Deviatior	0.4098	Standard Deviatior	0.7969	Standard Deviati	0.9853
Sample Variance	0.7191	Sample Variance	0.1679	Sample Variance	0.6351	Sample Variance	0.9707
Kurtosis	2.8052	Kurtosis	4.9152	Kurtosis	11.3946	Kurtosis	21.5568
Skewness	0.4214	Skewness	-0.3470	Skewness	1.4422	Skewness	-2.3526
Range	7.7492	Range	3.9336	Range	9.0135	Range	12.7712
Minimum	-3.1484	Minimum	-2.2648	Minimum	-2.1479	Minimum	-9.2698
Maximum	4.6008	Maximum	1.6688	Maximum	6.8656	Maximum	3.5014
Sum	26.8764	Sum	17.8687	Sum	9.0077	Sum	86.7989
Count	473.0000	Count	473.0000	Count	473.0000	Count	473.0000
Largest(1)	4.6008	Largest(1)	1.6688	Largest(1)	6.8656	Largest(1)	3.5014
Smallest(1)	-3.1484	Smallest(1)	-2.2648	Smallest(1)	-2.1479	Smallest(1)	-9.2698
Confidence Leve	0.0766	Confidence Level(!	0.0370	Confidence Level(!	0.0720	Confidence Leve	0.0890

Without January and Pre/Post Holidays

Mean	0.0483	Mean	0.0386	Mean	0.0097	Mean	0.1856
Standard Error	0.0408	Standard Error	0.0196	Standard Error	0.0380	Standard Error	0.0478
Median	-0.0062	Median	0.0336	Median	-0.0346	Median	0.2197
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8502	Standard Deviation	0.4092	Standard Deviation	0.7916	Standard Deviation	0.9963
Sample Variance	0.7228	Sample Variance	0.1674	Sample Variance	0.6267	Sample Variance	0.9926
Kurtosis	3.0909	Kurtosis	5.2429	Kurtosis	12.8724	Kurtosis	22.2250
Skewness	0.4580	Skewness	-0.4158	Skewness	1.5894	Skewness	-2.5335
Range	7.7492	Range	3.9336	Range	9.0135	Range	12.4329
Minimum	-3.1484	Minimum	-2.2648	Minimum	-2.1479	Minimum	-9.2698
Maximum	4.6008	Maximum	1.6688	Maximum	6.8656	Maximum	3.1631
Sum	20.9940	Sum	16.7798	Sum	4.2141	Sum	80.7462
Count	435.0000	Count	435.0000	Count	435.0000	Count	435.0000
Largest(1)	4.6008	Largest(1)	1.6688	Largest(1)	6.8656	Largest(1)	3.1631
Smallest(1)	-3.1484	Smallest(1)	-2.2648	Smallest(1)	-2.1479	Smallest(1)	-9.2698
Confidence Level(95.0%)	0.0801	Confidence Level(95.0%)	0.0386	Confidence Level(95.0%)	0.0746	Confidence Level(95.0%)	0.0939

SP 500 and SP 500 Futures

With all days

S&P 500 Close-to-Close		SPF Close-to-Close		SPF Close-to-Open		Close(Intraday)		SPF Open-to-open	
Mean	0.0006	Mean	0.0007	Mean	0.0004	Mean	0.0003	Mean	0.0005
Standard Error	0.0004	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0000	Median	0.0001	Median	0.0002	Median	-0.0001	Median	0.0001
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0091	Standard Deviation	0.0101	Standard Deviation	0.0039	Standard Deviation	0.0092	Standard Deviation	0.0099
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	4.1745	Kurtosis	5.6677	Kurtosis	7.6870	Kurtosis	9.2316	Kurtosis	7.6833
Skewness	0.5675	Skewness	0.7608	Skewness	0.8665	Skewness	0.7791	Skewness	0.6421
Range	0.0868	Range	0.0963	Range	0.0435	Range	0.1199	Range	0.1184
Minimum	-0.0369	Minimum	-0.0398	Minimum	-0.0173	Minimum	-0.0464	Minimum	-0.0422
Maximum	0.0499	Maximum	0.0565	Maximum	0.0262	Maximum	0.0735	Maximum	0.0762
Sum	0.3298	Sum	0.3481	Sum	0.2076	Sum	0.1575	Sum	0.2757
Count	518.0000	Count	518.0000	Count	518.0000	Count	519.0000	Count	519.0000
Largest(1)	0.0499	Largest(1)	0.0565	Largest(1)	0.0262	Largest(1)	0.0735	Largest(1)	0.0762
Smallest(1)	-0.0369	Smallest(1)	-0.0398	Smallest(1)	-0.0173	Smallest(1)	-0.0464	Smallest(1)	-0.0422
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0003	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Without January

Mean	0.0005	Mean	0.0006	Mean	0.0004	Mean	0.0002	Mean	0.0005
Standard Error	0.0004	Standard Error	0.0005	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0000	Median	0.0001	Median	0.0002	Median	-0.0002	Median	0.0000
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0091	Standard Deviation	0.0101	Standard Deviation	0.0039	Standard Deviation	0.0092	Standard Deviation	0.0097
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	4.5246	Kurtosis	6.0304	Kurtosis	8.1928	Kurtosis	10.1957	Kurtosis	8.8692
Skewness	0.6330	Skewness	0.8523	Skewness	0.9297	Skewness	0.8800	Skewness	0.8904
Range	0.0868	Range	0.0963	Range	0.0435	Range	0.1199	Range	0.1184
Minimum	-0.0369	Minimum	-0.0398	Minimum	-0.0173	Minimum	-0.0464	Minimum	-0.0422
Maximum	0.0499	Maximum	0.0565	Maximum	0.0262	Maximum	0.0735	Maximum	0.0762
Sum	0.2437	Sum	0.2741	Sum	0.1835	Sum	0.0905	Sum	0.2203
Count	476.0000	Count	476.0000	Count	476.0000	Count	476.0000	Count	476.0000
Largest(1)	0.0499	Largest(1)	0.0565	Largest(1)	0.0262	Largest(1)	0.0735	Largest(1)	0.0762
Smallest(1)	-0.0369	Smallest(1)	-0.0398	Smallest(1)	-0.0173	Smallest(1)	-0.0464	Smallest(1)	-0.0422
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0004	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Without Pre/Post Holidays

S&P 500 Close-to-Close		***SPF Close-to-Close***		***SPF Close-to-Open***		***Close(Intraday)***		***SPF Open-to-open***	
Mean	0.0006	Mean	0.0005	Mean	0.0003	Mean	0.0002	Mean	0.0005
Standard Error	0.0004	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0000	Median	0.0001	Median	0.0001	Median	-0.0002	Median	0.0001
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0087	Standard Deviation	0.0096	Standard Deviation	0.0036	Standard Deviation	0.0090	Standard Deviation	0.0098
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	3.5387	Kurtosis	5.5620	Kurtosis	5.6279	Kurtosis	10.8755	Kurtosis	8.8096
Skewness	0.3409	Skewness	0.5519	Skewness	0.4745	Skewness	0.8654	Skewness	0.7037
Range	0.0868	Range	0.0963	Range	0.0357	Range	0.1199	Range	0.1184
Minimum	-0.0369	Minimum	-0.0398	Minimum	-0.0173	Minimum	-0.0464	Minimum	-0.0422
Maximum	0.0499	Maximum	0.0565	Maximum	0.0184	Maximum	0.0735	Maximum	0.0762
Sum	0.2619	Sum	0.2191	Sum	0.1435	Sum	0.0756	Sum	0.2198
Count	473.0000	Count	473.0000	Count	473.0000	Count	473.0000	Count	473.0000
Largest(1)	0.0499	Largest(1)	0.0565	Largest(1)	0.0184	Largest(1)	0.0735	Largest(1)	0.0762
Smallest(1)	-0.0369	Smallest(1)	-0.0398	Smallest(1)	-0.0173	Smallest(1)	-0.0464	Smallest(1)	-0.0422
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0003	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Without January and Pre/Post Holidays

Mean	0.0005	Mean	0.0004	Mean	0.0003	Mean	0.0001	Mean	0.0005
Standard Error	0.0004	Standard Error	0.0005	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0005
Median	-0.0001	Median	0.0000	Median	0.0001	Median	-0.0002	Median	0.0001
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0088	Standard Deviation	0.0097	Standard Deviation	0.0036	Standard Deviation	0.0090	Standard Deviation	0.0095
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	3.8634	Kurtosis	5.9542	Kurtosis	6.0010	Kurtosis	11.9000	Kurtosis	10.1547
Skewness	0.3898	Skewness	0.6334	Skewness	0.5091	Skewness	0.9693	Skewness	0.9743
Range	0.0868	Range	0.0963	Range	0.0357	Range	0.1199	Range	0.1184
Minimum	-0.0369	Minimum	-0.0398	Minimum	-0.0173	Minimum	-0.0464	Minimum	-0.0422
Maximum	0.0499	Maximum	0.0565	Maximum	0.0184	Maximum	0.0735	Maximum	0.0762
Sum	0.2070	Sum	0.1798	Sum	0.1282	Sum	0.0516	Sum	0.2162
Count	435.0000	Count	435.0000	Count	435.0000	Count	435.0000	Count	435.0000
Largest(1)	0.0499	Largest(1)	0.0565	Largest(1)	0.0184	Largest(1)	0.0735	Largest(1)	0.0762
Smallest(1)	-0.0369	Smallest(1)	-0.0398	Smallest(1)	-0.0173	Smallest(1)	-0.0464	Smallest(1)	-0.0422
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0003	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Wednesday

Dow Jones Industrial Average

With all days

DJIA Close-to-Close		DJIA Close-to-Open		(Intraday)		DJIA Open-to-open	
Mean	0.0472	Mean	0.0112	Mean	0.0360	Mean	0.0449
Standard Error	0.0337	Standard Error	0.0197	Standard Error	0.0323	Standard Error	0.0423
Median	0.0354	Median	0.0157	Median	0.0626	Median	0.0154
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.7666	Standard Deviation	0.4466	Standard Deviation	0.7327	Standard Deviation	0.9608
Sample Variance	0.5877	Sample Variance	0.1995	Sample Variance	0.5369	Sample Variance	0.9231
Kurtosis	1.5475	Kurtosis	12.9899	Kurtosis	0.6322	Kurtosis	7.0954
Skewness	0.0296	Skewness	-1.5874	Skewness	-0.1571	Skewness	0.5356
Range	6.1934	Range	5.5048	Range	4.6380	Range	11.2426
Minimum	-2.9883	Minimum	-3.3978	Minimum	-2.4350	Minimum	-4.2200
Maximum	3.2051	Maximum	2.1070	Maximum	2.2030	Maximum	7.0226
Sum	24.3652	Sum	5.7745	Sum	18.5907	Sum	23.1443
Count	516.0000	Count	516.0000	Count	516.0000	Count	516.0000
Largest(1)	3.2051	Largest(1)	2.1070	Largest(1)	2.2030	Largest(1)	7.0226
Smallest(1)	-2.9883	Smallest(1)	-3.3978	Smallest(1)	-2.4350	Smallest(1)	-4.2200
Confidence Level(95.0%)	0.0663	Confidence Level(95.0%)	0.0386	Confidence Level(95.0%)	0.0634	Confidence Level(95.0%)	0.0831

Without January

Mean	0.0509	Mean	0.0214	Mean	0.0295	Mean	0.0382
Standard Error	0.0344	Standard Error	0.0191	Standard Error	0.0327	Standard Error	0.0426
Median	0.0437	Median	0.0172	Median	0.0488	Median	0.0143
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.7489	Standard Deviation	0.4154	Standard Deviation	0.7122	Standard Deviation	0.9275
Sample Variance	0.5608	Sample Variance	0.1725	Sample Variance	0.5073	Sample Variance	0.8603
Kurtosis	1.7531	Kurtosis	12.3327	Kurtosis	0.5320	Kurtosis	8.2598
Skewness	-0.0135	Skewness	-1.0432	Skewness	-0.1469	Skewness	0.8224
Range	6.1934	Range	5.5048	Range	4.3584	Range	11.2426
Minimum	-2.9883	Minimum	-3.3978	Minimum	-2.3041	Minimum	-4.2200
Maximum	3.2051	Maximum	2.1070	Maximum	2.0543	Maximum	7.0226
Sum	24.0855	Sum	10.1311	Sum	13.9545	Sum	18.0605
Count	473.0000	Count	473.0000	Count	473.0000	Count	473.0000
Largest(1)	3.2051	Largest(1)	2.1070	Largest(1)	2.0543	Largest(1)	7.0226
Smallest(1)	-2.9883	Smallest(1)	-3.3978	Smallest(1)	-2.3041	Smallest(1)	-4.2200
Confidence Level(95.0%)	0.0677	Confidence Level(95.0%)	0.0375	Confidence Level(95.0%)	0.0644	Confidence Level(95.0%)	0.0838

Without Pre/Post Holidays

DJIA Close-to-Close		*DJIA Close-to-Open*		*(Intraday)*		*DJIA Open-to-open*	
Mean	0.0511	Mean	0.0127	Mean	0.0383	Mean	0.0520
Standard Error	0.0346	Standard Error	0.0202	Standard Error	0.0332	Standard Error	0.0431
Median	0.0368	Median	0.0159	Median	0.0572	Median	0.0210
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.7732	Standard Deviation	0.4503	Standard Deviation	0.7405	Standard Deviation	0.9620
Sample Variance	0.5979	Sample Variance	0.2028	Sample Variance	0.5484	Sample Variance	0.9254
Kurtosis	1.5185	Kurtosis	12.9863	Kurtosis	0.5918	Kurtosis	7.2472
Skewness	0.0282	Skewness	-1.5990	Skewness	-0.1594	Skewness	0.5712
Range	6.1934	Range	5.5048	Range	4.6380	Range	11.2426
Minimum	-2.9883	Minimum	-3.3978	Minimum	-2.4350	Minimum	-4.2200
Maximum	3.2051	Maximum	2.1070	Maximum	2.2030	Maximum	7.0226
Sum	25.4819	Sum	6.3526	Sum	19.1293	Sum	25.9718
Count	499.0000	Count	499.0000	Count	499.0000	Count	499.0000
Largest(1)	3.2051	Largest(1)	2.1070	Largest(1)	2.2030	Largest(1)	7.0226
Smallest(1)	-2.9883	Smallest(1)	-3.3978	Smallest(1)	-2.4350	Smallest(1)	-4.2200
Confidence Level(95.0%)	0.0680	Confidence Level(95.0%)	0.0396	Confidence Level(95.0%)	0.0651	Confidence Level(95.0%)	0.0846

Without January and Pre/Post Holidays

Mean	0.0532	Mean	0.0229	Mean	0.0303	Mean	0.0456
Standard Error	0.0354	Standard Error	0.0196	Standard Error	0.0337	Standard Error	0.0433
Median	0.0437	Median	0.0172	Median	0.0479	Median	0.0177
Mode	#N/A	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.7561	Standard Deviation	0.4182	Standard Deviation	0.7201	Standard Deviation	0.9267
Sample Variance	0.5716	Sample Variance	0.1749	Sample Variance	0.5186	Sample Variance	0.8587
Kurtosis	1.7116	Kurtosis	12.4061	Kurtosis	0.4874	Kurtosis	8.5143
Skewness	-0.0110	Skewness	-1.0501	Skewness	-0.1439	Skewness	0.8798
Range	6.1934	Range	5.5048	Range	4.3584	Range	11.2426
Minimum	-2.9883	Minimum	-3.3978	Minimum	-2.3041	Minimum	-4.2200
Maximum	3.2051	Maximum	2.1070	Maximum	2.0543	Maximum	7.0226
Sum	24.3244	Sum	10.4647	Sum	13.8596	Sum	20.8598
Count	457.0000	Count	457.0000	Count	457.0000	Count	457.0000
Largest(1)	3.2051	Largest(1)	2.1070	Largest(1)	2.0543	Largest(1)	7.0226
Smallest(1)	-2.9883	Smallest(1)	-3.3978	Smallest(1)	-2.3041	Smallest(1)	-4.2200
Confidence Level(95.0%)	0.0695	Confidence Level(95.0%)	0.0384	Confidence Level(95.0%)	0.0662	Confidence Level(95.0%)	0.0852

SP 500 and SP 500 Futures

With all days

Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*Close(Intraday)*		*SPF Open-to-open*	
Mean	0.0008	Mean	0.0007	Mean	0.0002	Mean	0.0005	Mean	0.0004
Standard Error	0.0003	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0003	Standard Error	0.0004
Median	0.0007	Median	0.0007	Median	0.0002	Median	0.0006	Median	0.0009
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0078	Standard Deviation	0.0082	Standard Deviation	0.0036	Standard Deviation	0.0078	Standard Deviation	0.0097
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	2.4813	Kurtosis	1.5807	Kurtosis	5.6375	Kurtosis	0.9815	Kurtosis	5.8888
Skewness	-0.0685	Skewness	0.0556	Skewness	-0.4916	Skewness	-0.0937	Skewness	-0.5710
Range	0.0731	Range	0.0663	Range	0.0385	Range	0.0528	Range	0.1117
Minimum	-0.0383	Minimum	-0.0302	Minimum	-0.0218	Minimum	-0.0242	Minimum	-0.0607
Maximum	0.0348	Maximum	0.0361	Maximum	0.0167	Maximum	0.0287	Maximum	0.0510
Sum	0.4094	Sum	0.3749	Sum	0.1220	Sum	0.2529	Sum	0.2037
Count	516.0000	Count	516.0000	Count	516.0000	Count	516.0000	Count	516.0000
Largest(1)	0.0348	Largest(1)	0.0361	Largest(1)	0.0167	Largest(1)	0.0287	Largest(1)	0.0510
Smallest(1)	-0.0383	Smallest(1)	-0.0302	Smallest(1)	-0.0218	Smallest(1)	-0.0242	Smallest(1)	-0.0607
Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0003	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0008

Without January

Mean	0.0008	Mean	0.0007	Mean	0.0003	Mean	0.0004	Mean	0.0002
Standard Error	0.0004	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0007	Median	0.0007	Median	0.0003	Median	0.0006	Median	0.0007
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0077	Standard Deviation	0.0082	Standard Deviation	0.0035	Standard Deviation	0.0078	Standard Deviation	0.0095
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	2.7551	Kurtosis	1.7934	Kurtosis	3.6600	Kurtosis	1.0605	Kurtosis	5.3636
Skewness	-0.1079	Skewness	0.0503	Skewness	0.0371	Skewness	-0.1092	Skewness	-0.9566
Range	0.0731	Range	0.0663	Range	0.0327	Range	0.0528	Range	0.0916
Minimum	-0.0383	Minimum	-0.0302	Minimum	-0.0160	Minimum	-0.0242	Minimum	-0.0607
Maximum	0.0348	Maximum	0.0361	Maximum	0.0167	Maximum	0.0287	Maximum	0.0309
Sum	0.3689	Sum	0.3265	Sum	0.1353	Sum	0.1912	Sum	0.0963
Count	473.0000	Count	473.0000	Count	473.0000	Count	473.0000	Count	473.0000
Largest(1)	0.0348	Largest(1)	0.0361	Largest(1)	0.0167	Largest(1)	0.0287	Largest(1)	0.0309
Smallest(1)	-0.0383	Smallest(1)	-0.0302	Smallest(1)	-0.0160	Smallest(1)	-0.0242	Smallest(1)	-0.0607
Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0003	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0009

Without Pre/Post Holidays

Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*Close(Intraday)*		*SPF Open-to-open*	
Mean	0.0009	Mean	0.0008	Mean	0.0002	Mean	0.0005	Mean	0.0004
Standard Error	0.0003	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0008	Median	0.0007	Median	0.0003	Median	0.0007	Median	0.0010
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0076	Standard Deviation	0.0083	Standard Deviation	0.0036	Standard Deviation	0.0079	Standard Deviation	0.0097
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	1.6155	Kurtosis	1.5588	Kurtosis	5.7548	Kurtosis	0.9570	Kurtosis	5.9115
Skewness	0.1617	Skewness	0.0576	Skewness	-0.5021	Skewness	-0.1014	Skewness	-0.5732
Range	0.0658	Range	0.0663	Range	0.0385	Range	0.0528	Range	0.1117
Minimum	-0.0310	Minimum	-0.0302	Minimum	-0.0218	Minimum	-0.0242	Minimum	-0.0607
Maximum	0.0348	Maximum	0.0361	Maximum	0.0167	Maximum	0.0287	Maximum	0.0510
Sum	0.4558	Sum	0.3783	Sum	0.1107	Sum	0.2675	Sum	0.2220
Count	499.0000	Count	499.0000	Count	499.0000	Count	499.0000	Count	499.0000
Largest(1)	0.0348	Largest(1)	0.0361	Largest(1)	0.0167	Largest(1)	0.0287	Largest(1)	0.0510
Smallest(1)	-0.0310	Smallest(1)	-0.0302	Smallest(1)	-0.0218	Smallest(1)	-0.0242	Smallest(1)	-0.0607
Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0003	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0009

Without January and Pre/Post Holidays

Mean	0.0009	Mean	0.0007	Mean	0.0003	Mean	0.0004	Mean	0.0002
Standard Error	0.0004	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0008	Median	0.0007	Median	0.0003	Median	0.0007	Median	0.0007
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0076	Standard Deviation	0.0083	Standard Deviation	0.0035	Standard Deviation	0.0078	Standard Deviation	0.0096
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	1.7765	Kurtosis	1.7461	Kurtosis	3.7777	Kurtosis	1.0134	Kurtosis	5.3789
Skewness	0.1472	Skewness	0.0551	Skewness	0.0415	Skewness	-0.1139	Skewness	-0.9577
Range	0.0658	Range	0.0663	Range	0.0327	Range	0.0528	Range	0.0916
Minimum	-0.0310	Minimum	-0.0302	Minimum	-0.0160	Minimum	-0.0242	Minimum	-0.0607
Maximum	0.0348	Maximum	0.0361	Maximum	0.0167	Maximum	0.0287	Maximum	0.0309
Sum	0.4038	Sum	0.3183	Sum	0.1238	Sum	0.1944	Sum	0.1061
Count	457.0000	Count	457.0000	Count	457.0000	Count	457.0000	Count	457.0000
Largest(1)	0.0348	Largest(1)	0.0361	Largest(1)	0.0167	Largest(1)	0.0287	Largest(1)	0.0309
Smallest(1)	-0.0310	Smallest(1)	-0.0302	Smallest(1)	-0.0160	Smallest(1)	-0.0242	Smallest(1)	-0.0607
Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0003	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0009

Thursday

Dow Jones Industrial Average

With all days

DJIA Close-to-Close		*DJIA Close-to-Open*		*(Intraday)*		*DJIA Open-to-open*	
Mean	-0.0385	Mean	0.0130	Mean	-0.0515	Mean	0.0505
Standard Error	0.0401	Standard Error	0.0213	Standard Error	0.0328	Standard Error	0.0408
Median	-0.0255	Median	0.0107	Median	-0.0292	Median	0.0647
Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	#N/A
Standard Deviation	0.9045	Standard Deviation	0.4808	Standard Deviation	0.7386	Standard Deviation	0.9195
Sample Variance	0.8181	Sample Variance	0.2312	Sample Variance	0.5456	Sample Variance	0.8454
Kurtosis	3.0645	Kurtosis	11.3444	Kurtosis	2.5879	Kurtosis	3.1495
Skewness	-0.1339	Skewness	-0.3094	Skewness	-0.0402	Skewness	-0.3483
Range	8.7496	Range	6.2683	Range	6.8138	Range	9.1881
Minimum	-4.2831	Minimum	-2.6354	Minimum	-2.5618	Minimum	-4.6834
Maximum	4.4665	Maximum	3.6328	Maximum	4.2520	Maximum	4.5047
Sum	-19.5402	Sum	6.6156	Sum	-26.1557	Sum	25.6362
Count	508.0000	Count	508.0000	Count	508.0000	Count	508.0000
Largest(1)	4.4665	Largest(1)	3.6328	Largest(1)	4.2520	Largest(1)	4.5047
Smallest(1)	-4.2831	Smallest(1)	-2.6354	Smallest(1)	-2.5618	Smallest(1)	-4.6834
Confidence Level(95.0%)	0.0788	Confidence Level(95.0%)	0.0419	Confidence Level(95.0%)	0.0644	Confidence Level(95.0%)	0.0801

Without January

Mean	-0.0430	Mean	0.0062	Mean	-0.0492	Mean	0.0442
Standard Error	0.0410	Standard Error	0.0212	Standard Error	0.0339	Standard Error	0.0417
Median	-0.0306	Median	0.0122	Median	-0.0344	Median	0.0672
Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	#N/A
Standard Deviation	0.8844	Standard Deviation	0.4574	Standard Deviation	0.7311	Standard Deviation	0.8989
Sample Variance	0.7822	Sample Variance	0.2092	Sample Variance	0.5344	Sample Variance	0.8080
Kurtosis	2.5310	Kurtosis	7.3607	Kurtosis	2.8916	Kurtosis	2.6932
Skewness	-0.3612	Skewness	-1.3915	Skewness	0.0606	Skewness	-0.6497
Range	8.3478	Range	4.0929	Range	6.8138	Range	7.2645
Minimum	-4.2831	Minimum	-2.6354	Minimum	-2.5618	Minimum	-4.6834
Maximum	4.0647	Maximum	1.4575	Maximum	4.2520	Maximum	2.5812
Sum	-20.0073	Sum	2.8863	Sum	-22.8937	Sum	20.5661
Count	465.0000	Count	465.0000	Count	465.0000	Count	465.0000
Largest(1)	4.0647	Largest(1)	1.4575	Largest(1)	4.2520	Largest(1)	2.5812
Smallest(1)	-4.2831	Smallest(1)	-2.6354	Smallest(1)	-2.5618	Smallest(1)	-4.6834
Confidence Level(95.0%)	0.0806	Confidence Level(95.0%)	0.0417	Confidence Level(95.0%)	0.0666	Confidence Level(95.0%)	0.0819

Without Pre/Post Holidays

DJIA Close-to-Close		*DJIA Close-to-Open*		*(Intraday)*		*DJIA Open-to-open*	
Mean	-0.0432	Mean	0.0050	Mean	-0.0483	Mean	0.0454
Standard Error	0.0413	Standard Error	0.0221	Standard Error	0.0337	Standard Error	0.0421
Median	-0.0306	Median	0.0074	Median	-0.0259	Median	0.0578
Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	#N/A
Standard Deviation	0.9084	Standard Deviation	0.4856	Standard Deviation	0.7406	Standard Deviation	0.9254
Sample Variance	0.8252	Sample Variance	0.2358	Sample Variance	0.5484	Sample Variance	0.8564
Kurtosis	3.1538	Kurtosis	11.3929	Kurtosis	2.6411	Kurtosis	3.2126
Skewness	-0.1255	Skewness	-0.3110	Skewness	-0.0055	Skewness	-0.3478
Range	8.7496	Range	6.2683	Range	6.8138	Range	9.1881
Minimum	-4.2831	Minimum	-2.6354	Minimum	-2.5618	Minimum	-4.6834
Maximum	4.4665	Maximum	3.6328	Maximum	4.2520	Maximum	4.5047
Sum	-20.8789	Sum	2.4383	Sum	-23.3172	Sum	21.9233
Count	483.0000	Count	483.0000	Count	483.0000	Count	483.0000
Largest(1)	4.4665	Largest(1)	3.6328	Largest(1)	4.2520	Largest(1)	4.5047
Smallest(1)	-4.2831	Smallest(1)	-2.6354	Smallest(1)	-2.5618	Smallest(1)	-4.6834
Confidence Level(95.0%)	0.0812	Confidence Level(95.0%)	0.0434	Confidence Level(95.0%)	0.0662	Confidence Level(95.0%)	0.0827

Without January and Pre/Post Holidays

Mean	-0.0482	Mean	-0.0036	Mean	-0.0446	Mean	0.0340
Standard Error	0.0421	Standard Error	0.0219	Standard Error	0.0348	Standard Error	0.0431
Median	-0.0485	Median	0.0078	Median	-0.0338	Median	0.0573
Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	#N/A
Standard Deviation	0.8857	Standard Deviation	0.4611	Standard Deviation	0.7319	Standard Deviation	0.9052
Sample Variance	0.7845	Sample Variance	0.2126	Sample Variance	0.5357	Sample Variance	0.8194
Kurtosis	2.6407	Kurtosis	7.2990	Kurtosis	2.9666	Kurtosis	2.7094
Skewness	-0.3642	Skewness	-1.4268	Skewness	0.1028	Skewness	-0.6521
Range	8.3478	Range	4.0929	Range	6.8138	Range	7.2645
Minimum	-4.2831	Minimum	-2.6354	Minimum	-2.5618	Minimum	-4.6834
Maximum	4.0647	Maximum	1.4575	Maximum	4.2520	Maximum	2.5812
Sum	-21.3228	Sum	-1.6130	Sum	-19.7098	Sum	15.0204
Count	442.0000	Count	442.0000	Count	442.0000	Count	442.0000
Largest(1)	4.0647	Largest(1)	1.4575	Largest(1)	4.2520	Largest(1)	2.5812
Smallest(1)	-4.2831	Smallest(1)	-2.6354	Smallest(1)	-2.5618	Smallest(1)	-4.6834
Confidence Level(95.0%)	0.0828	Confidence Level(95.0%)	0.0431	Confidence Level(95.0%)	0.0684	Confidence Level(95.0%)	0.0846

SP 500 Index and SP 500 Futures

All days

Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*Close(Intraday)*		*SPF Open-to-open*	
Mean	-0.0003	Mean	-0.0003	Mean	-0.0001	Mean	-0.0003	Mean	0.0001
Standard	0.0004	Standard	0.0004	Standard	0.0002	Standard	0.0004	Standard	0.0004
Median	-0.0001	Median	0.0000	Median	0.0000	Median	0.0001	Median	0.0006
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0090	Standard Deviation	0.0097	Standard Deviation	0.0048	Standard Deviation	0.0083	Standard Deviation	0.0101
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	2.3755	Kurtosis	3.9697	Kurtosis	18.9130	Kurtosis	4.6642	Kurtosis	2.6097
Skewness	-0.0157	Skewness	-0.0872	Skewness	-1.1879	Skewness	0.1900	Skewness	-0.0446
Range	0.0800	Range	0.1001	Range	0.0751	Range	0.0878	Range	0.0960
Minimum	-0.0391	Minimum	-0.0488	Minimum	-0.0386	Minimum	-0.0325	Minimum	-0.0431
Maximum	0.0409	Maximum	0.0513	Maximum	0.0366	Maximum	0.0553	Maximum	0.0530
Sum	-0.1637	Sum	-0.1774	Sum	-0.0460	Sum	-0.1314	Sum	0.0586
Count	508.0000	Count	508.0000	Count	508.0000	Count	508.0000	Count	508.0000
Largest(1)	0.0409	Largest(1)	0.0513	Largest(1)	0.0366	Largest(1)	0.0553	Largest(1)	0.0530
Smallest(1)	-0.0391	Smallest(1)	-0.0488	Smallest(1)	-0.0386	Smallest(1)	-0.0325	Smallest(1)	-0.0431
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0004	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0009

Without January

Mean	-0.0004	Mean	-0.0004	Mean	-0.0002	Mean	-0.0002	Mean	0.0002
Standard	0.0004	Standard	0.0004	Standard	0.0002	Standard	0.0004	Standard	0.0005
Median	-0.0001	Median	0.0000	Median	0.0000	Median	0.0000	Median	0.0005
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0089	Standard Deviation	0.0095	Standard Deviation	0.0046	Standard Deviation	0.0082	Standard Deviation	0.0101
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	2.3124	Kurtosis	3.9669	Kurtosis	16.2445	Kurtosis	5.1584	Kurtosis	2.8066
Skewness	-0.1502	Skewness	-0.2168	Skewness	-2.4964	Skewness	0.2932	Skewness	-0.0102
Range	0.0800	Range	0.1001	Range	0.0553	Range	0.0878	Range	0.0960
Minimum	-0.0391	Minimum	-0.0488	Minimum	-0.0386	Minimum	-0.0325	Minimum	-0.0431
Maximum	0.0409	Maximum	0.0513	Maximum	0.0167	Maximum	0.0553	Maximum	0.0530
Sum	-0.1707	Sum	-0.1731	Sum	-0.0959	Sum	-0.0773	Sum	0.0894
Count	465.0000	Count	465.0000	Count	465.0000	Count	465.0000	Count	465.0000
Largest(1)	0.0409	Largest(1)	0.0513	Largest(1)	0.0167	Largest(1)	0.0553	Largest(1)	0.0530
Smallest(1)	-0.0391	Smallest(1)	-0.0488	Smallest(1)	-0.0386	Smallest(1)	-0.0325	Smallest(1)	-0.0431
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0004	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Without Pre/Post Holidays

Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*Close(Intraday)*		*SPF Open-to-open*	
Mean	-0.0004	Mean	-0.0004	Mean	-0.0002	Mean	-0.0002	Mean	0.0002
Standard	0.0004	Standard	0.0004	Standard	0.0002	Standard	0.0004	Standard	0.0005
Median	-0.0001	Median	0.0000	Median	0.0000	Median	0.0000	Median	0.0005
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0090	Standard Deviation	0.0098	Standard Deviation	0.0049	Standard Deviation	0.0083	Standard Deviation	0.0101
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	2.4183	Kurtosis	4.0175	Kurtosis	18.8228	Kurtosis	4.6687	Kurtosis	2.6667
Skewness	-0.0004	Skewness	-0.0402	Skewness	-1.1915	Skewness	0.2878	Skewness	0.0039
Range	0.0800	Range	0.1001	Range	0.0751	Range	0.0878	Range	0.0960
Minimum	-0.0391	Minimum	-0.0488	Minimum	-0.0386	Minimum	-0.0325	Minimum	-0.0431
Maximum	0.0409	Maximum	0.0513	Maximum	0.0366	Maximum	0.0553	Maximum	0.0530
Sum	-0.1773	Sum	-0.1980	Sum	-0.0786	Sum	-0.1194	Sum	0.0761
Count	483.0000	Count	483.0000	Count	483.0000	Count	483.0000	Count	483.0000
Largest(1)	0.0409	Largest(1)	0.0513	Largest(1)	0.0366	Largest(1)	0.0553	Largest(1)	0.0530
Smallest(1)	-0.0391	Smallest(1)	-0.0488	Smallest(1)	-0.0386	Smallest(1)	-0.0325	Smallest(1)	-0.0431
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0004	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0009

Without January and Pre/Post Holidays

Mean	-0.0004	Mean	-0.0004	Mean	-0.0003	Mean	-0.0001	Mean	0.0002
Standard	0.0004	Standard	0.0005	Standard	0.0002	Standard	0.0004	Standard	0.0005
Median	-0.0001	Median	0.0000	Median	0.0000	Median	0.0000	Median	0.0005
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.0089	Standard Deviation	0.0096	Standard Deviation	0.0047	Standard Deviation	0.0082	Standard Deviation	0.0101
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	2.3769	Kurtosis	4.0465	Kurtosis	16.0418	Kurtosis	5.1661	Kurtosis	2.8959
Skewness	-0.1360	Skewness	-0.1732	Skewness	-2.5160	Skewness	0.4069	Skewness	0.0430
Range	0.0800	Range	0.1001	Range	0.0553	Range	0.0878	Range	0.0960
Minimum	-0.0391	Minimum	-0.0488	Minimum	-0.0386	Minimum	-0.0325	Minimum	-0.0431
Maximum	0.0409	Maximum	0.0513	Maximum	0.0167	Maximum	0.0553	Maximum	0.0530
Sum	-0.1890	Sum	-0.1884	Sum	-0.1249	Sum	-0.0635	Sum	0.1097
Count	442.0000	Count	442.0000	Count	442.0000	Count	442.0000	Count	442.0000
Largest(1)	0.0409	Largest(1)	0.0513	Largest(1)	0.0167	Largest(1)	0.0553	Largest(1)	0.0530
Smallest(1)	-0.0391	Smallest(1)	-0.0488	Smallest(1)	-0.0386	Smallest(1)	-0.0325	Smallest(1)	-0.0431
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0004	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Friday

Dow Jones Industrial Average

All days

DJIA Close-to-Close		DJIA Close-to-		DJIA Open-to-		DJIA Open-to-open	
Mean	0.0497	Mean	0.0559	Mean	-0.0062	Mean	0.0073
Standard Error	0.0398	Standard Error	0.0230	Standard Error	0.0351	Standard Error	0.0432
Median	0.0709	Median	0.0835	Median	0.0087	Median	0.0675
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8920	Standard Deviation	0.5157	Standard Deviation	0.7870	Standard Deviation	0.9694
Sample Variance	0.7957	Sample Variance	0.2659	Sample Variance	0.6194	Sample Variance	0.9397
Kurtosis	1.6332	Kurtosis	2.3561	Kurtosis	1.9839	Kurtosis	2.7865
Skewness	-0.3984	Skewness	-0.4312	Skewness	-0.2578	Skewness	-0.0119
Range	6.8048	Range	3.8250	Range	6.8166	Range	9.4413
Minimum	-4.0064	Minimum	-2.0531	Minimum	-3.8457	Minimum	-4.1646
Maximum	2.7984	Maximum	1.7719	Maximum	2.9709	Maximum	5.2767
Sum	24.9834	Sum	28.1174	Sum	-3.1341	Sum	3.6673
Count	503.0000	Count	503.0000	Count	503.0000	Count	503.0000
Largest(1)	2.7984	Largest(1)	1.7719	Largest(1)	2.9709	Largest(1)	5.2767
Smallest(1 e	-4.0064	Smallest(1 e	-2.0531	Smallest(1 e	-3.8457	Smallest(1 e	-4.1646
Level(95.0 %)	0.0781	Level(95.0 %)	0.0452	Level(95.0 %)	0.0689	Level(95.0 %)	0.0849

Without January

Mean	0.0392	Mean	0.0583	Mean	-0.0191	Mean	0.0150
Standard Error	0.0411	Standard Error	0.0241	Standard Error	0.0363	Standard Error	0.0453
Median	0.0543	Median	0.0851	Median	0.0087	Median	0.0591
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8824	Standard Deviation	0.5168	Standard Deviation	0.7795	Standard Deviation	0.9711
Sample Variance	0.7786	Sample Variance	0.2671	Sample Variance	0.6076	Sample Variance	0.9431
Kurtosis	1.6260	Kurtosis	2.4517	Kurtosis	2.0648	Kurtosis	3.0233
Skewness	-0.3363	Skewness	-0.4096	Skewness	-0.2611	Skewness	0.0359
Range	6.8048	Range	3.8250	Range	6.8166	Range	9.4413
Minimum	-4.0064	Minimum	-2.0531	Minimum	-3.8457	Minimum	-4.1646
Maximum	2.7984	Maximum	1.7719	Maximum	2.9709	Maximum	5.2767
Sum	18.0248	Sum	26.8320	Sum	-8.8072	Sum	6.8890
Count	460.0000	Count	460.0000	Count	460.0000	Count	460.0000
Largest(1)	2.7984	Largest(1)	1.7719	Largest(1)	2.9709	Largest(1)	5.2767
)	-4.0064	)	-2.0531	)	-3.8457	)	-4.1646
e		e		e		e	
Level(95.0 %)	0.0808	Level(95.0 %)	0.0474	Level(95.0 %)	0.0714	Level(95.0 %)	0.0890

Without Pre/Post Holidays

DJIA Close-to-Close		*DJIA Close-to-*		*DJIA Open-to-*		*DJIA Open-to-open*	
Mean	0.0505	Mean	0.0566	Mean	-0.0061	Mean	0.0267
Standard Error	0.0424	Standard Error	0.0248	Standard Error	0.0379	Standard Error	0.0466
Median	0.0932	Median	0.0842	Median	0.0160	Median	0.0921
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8995	Standard Deviation	0.5256	Standard Deviation	0.8046	Standard Deviation	0.9883
Sample Variance	0.8091	Sample Variance	0.2762	Sample Variance	0.6474	Sample Variance	0.9767
Kurtosis	1.6875	Kurtosis	2.3112	Kurtosis	1.9714	Kurtosis	2.8671
Skewness	-0.4820	Skewness	-0.4874	Skewness	-0.2977	Skewness	-0.0531
Range	6.8048	Range	3.8250	Range	6.8166	Range	9.4413
Minimum	-4.0064	Minimum	-2.0531	Minimum	-3.8457	Minimum	-4.1646
Maximum	2.7984	Maximum	1.7719	Maximum	2.9709	Maximum	5.2767
Sum	22.7345	Sum	25.4897	Sum	-2.7552	Sum	11.9947
Count	450.0000	Count	450.0000	Count	450.0000	Count	450.0000
Largest(1)	2.7984	Largest(1)	1.7719	Largest(1)	2.9709	Largest(1)	5.2767
Smallest(1	-4.0064	Smallest(1	-2.0531	Smallest(1	-3.8457	Smallest(1	-4.1646
e		e		e		e	
Level(95.0 %)	0.0833	Level(95.0 %)	0.0487	Level(95.0 %)	0.0745	Level(95.0 %)	0.0916

Without January and Pre/Post Holidays

Mean	0.0480	Mean	0.0643	Mean	-0.0163	Mean	0.0347
Standard Error	0.0442	Standard Error	0.0262	Standard Error	0.0395	Standard Error	0.0489
Median	0.0693	Median	0.0919	Median	0.0160	Median	0.0830
Mode	0.0000	Mode	0.0000	Mode	0.0000	Mode	0.0000
Standard Deviation	0.8951	Standard Deviation	0.5298	Standard Deviation	0.7993	Standard Deviation	0.9904
Sample Variance	0.8013	Sample Variance	0.2807	Sample Variance	0.6389	Sample Variance	0.9809
Kurtosis	1.6690	Kurtosis	2.3492	Kurtosis	2.0311	Kurtosis	3.1196
Skewness	-0.3984	Skewness	-0.4635	Skewness	-0.2995	Skewness	-0.0047
Range	6.8048	Range	3.8250	Range	6.8166	Range	9.4413
Minimum	-4.0064	Minimum	-2.0531	Minimum	-3.8457	Minimum	-4.1646
Maximum	2.7984	Maximum	1.7719	Maximum	2.9709	Maximum	5.2767
Sum	19.6708	Sum	26.3430	Sum	-6.6722	Sum	14.2079
Count	410.0000	Count	410.0000	Count	410.0000	Count	410.0000
Largest(1)	2.7984	Largest(1)	1.7719	Largest(1)	2.9709	Largest(1)	5.2767
)	-4.0064	)	-2.0531	)	-3.8457	)	-4.1646
e Level(95.0%)	0.0869	e Level(95.0%)	0.0514	e Level(95.0%)	0.0776	e Level(95.0%)	0.0962

SP 500 and SP 500 Futures

All days

S&P 500 Close-to-Close		***SPF Close-to-Close***		***SPF Close-to-Open***		***SPF Open-to-Close(Intraday)***		***SPF Open-to-open***	
Mean	0.0006	Mean	0.0004	Mean	0.0004	Mean	0.0001	Mean	0.0005
Standard Error	0.0004	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0004
Median	0.0008	Median	0.0005	Median	0.0005	Median	0.0006	Median	0.0004
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0089	Standard Deviation	0.0097	Standard Deviation	0.0051	Standard Deviation	0.0083	Standard Deviation	0.0100
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	1.7876	Kurtosis	2.2128	Kurtosis	4.1198	Kurtosis	2.8438	Kurtosis	3.3268
Skewness	-0.2903	Skewness	-0.1869	Skewness	-0.2841	Skewness	-0.1474	Skewness	0.1446
Range	0.0663	Range	0.0809	Range	0.0405	Range	0.0775	Range	0.0933
Minimum	-0.0373	Minimum	-0.0370	Minimum	-0.0195	Minimum	-0.0376	Minimum	-0.0442
Maximum	0.0290	Maximum	0.0440	Maximum	0.0210	Maximum	0.0399	Maximum	0.0491
Sum	0.2835	Sum	0.2231	Sum	0.1860	Sum	0.0370	Sum	0.2652
Count	503.0000	Count	503.0000	Count	503.0000	Count	503.0000	Count	502.0000
Largest(1)	0.0290	Largest(1)	0.0440	Largest(1)	0.0210	Largest(1)	0.0399	Largest(1)	0.0491
Smallest(1)	-0.0373	Smallest(1)	-0.0370	Smallest(1)	-0.0195	Smallest(1)	-0.0376	Smallest(1)	-0.0442
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0004	Confidence Level(95.0%)	0.0007	Confidence Level(95.0%)	0.0009

Without January

Mean	0.0005	Mean	0.0004	Mean	0.0003	Mean	0.0001	Mean	0.0006
Standard Error	0.0004	Standard Error	0.0004	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0005
Median	0.0007	Median	0.0005	Median	0.0004	Median	0.0006	Median	0.0004
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0088	Standard Deviation	0.0096	Standard Deviation	0.0052	Standard Deviation	0.0082	Standard Deviation	0.0099
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	1.6705	Kurtosis	2.0641	Kurtosis	4.2294	Kurtosis	2.7260	Kurtosis	3.0603
Skewness	-0.2292	Skewness	-0.0718	Skewness	-0.2565	Skewness	-0.0563	Skewness	0.3138
Range	0.0663	Range	0.0809	Range	0.0405	Range	0.0775	Range	0.0882
Minimum	-0.0373	Minimum	-0.0370	Minimum	-0.0195	Minimum	-0.0376	Minimum	-0.0391
Maximum	0.0290	Maximum	0.0440	Maximum	0.0210	Maximum	0.0399	Maximum	0.0491
Sum	0.2405	Sum	0.1982	Sum	0.1539	Sum	0.0442	Sum	0.2726
Count	460.0000	Count	460.0000	Count	460.0000	Count	460.0000	Count	459.0000
Largest(1)	0.0290	Largest(1)	0.0440	Largest(1)	0.0210	Largest(1)	0.0399	Largest(1)	0.0491
Smallest(1)	-0.0373	Smallest(1)	-0.0370	Smallest(1)	-0.0195	Smallest(1)	-0.0376	Smallest(1)	-0.0391
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0005	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Without Pre/Post Holidays

S&P 500 Close-to-Close		*SPF Close-to-Close*		*SPF Close-to-Open*		*SPF Open-to-Close(Intraday)*		*SPF Open-to-open*	
Mean	0.0006	Mean	0.0005	Mean	0.0003	Mean	0.0001	Mean	0.0005
Standard Error	0.0004	Standard Error	0.0005	Standard Error	0.0002	Standard Error	0.0004	Standard Error	0.0005
Median	0.0008	Median	0.0006	Median	0.0004	Median	0.0007	Median	0.0004
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0089	Standard Deviation	0.0097	Standard Deviation	0.0052	Standard Deviation	0.0085	Standard Deviation	0.0102
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	1.8179	Kurtosis	2.2499	Kurtosis	3.9785	Kurtosis	2.8210	Kurtosis	3.4215
Skewness	-0.3989	Skewness	-0.2680	Skewness	-0.2827	Skewness	-0.1817	Skewness	0.1545
Range	0.0663	Range	0.0809	Range	0.0405	Range	0.0775	Range	0.0933
Minimum	-0.0373	Minimum	-0.0370	Minimum	-0.0195	Minimum	-0.0376	Minimum	-0.0442
Maximum	0.0290	Maximum	0.0440	Maximum	0.0210	Maximum	0.0399	Maximum	0.0491
Sum	0.2628	Sum	0.2069	Sum	0.1425	Sum	0.0643	Sum	0.2172
Count	450.0000	Count	450.0000	Count	450.0000	Count	450.0000	Count	449.0000
Largest(1)	0.0290	Largest(1)	0.0440	Largest(1)	0.0210	Largest(1)	0.0399	Largest(1)	0.0491
Smallest(1)	-0.0373	Smallest(1)	-0.0370	Smallest(1)	-0.0195	Smallest(1)	-0.0376	Smallest(1)	-0.0442
Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0005	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0009

Without January and Pre/Post Holidays

Mean	0.0006	Mean	0.0005	Mean	0.0003	Mean	0.0002	Mean	0.0006
Standard Error	0.0004	Standard Error	0.0005	Standard Error	0.0003	Standard Error	0.0004	Standard Error	0.0005
Median	0.0008	Median	0.0007	Median	0.0004	Median	0.0010	Median	0.0004
Mode	#N/A	Mode	0.0000	Mode	0.0000	Mode	#N/A	Mode	0.0000
Standard Deviation	0.0089	Standard Deviation	0.0098	Standard Deviation	0.0052	Standard Deviation	0.0084	Standard Deviation	0.0101
Sample Variance	0.0001	Sample Variance	0.0001	Sample Variance	0.0000	Sample Variance	0.0001	Sample Variance	0.0001
Kurtosis	1.6706	Kurtosis	2.0269	Kurtosis	3.9630	Kurtosis	2.6834	Kurtosis	3.1017
Skewness	-0.3070	Skewness	-0.1364	Skewness	-0.2487	Skewness	-0.0954	Skewness	0.3337
Range	0.0663	Range	0.0809	Range	0.0405	Range	0.0775	Range	0.0882
Minimum	-0.0373	Minimum	-0.0370	Minimum	-0.0195	Minimum	-0.0376	Minimum	-0.0391
Maximum	0.0290	Maximum	0.0440	Maximum	0.0210	Maximum	0.0399	Maximum	0.0491
Sum	0.2610	Sum	0.2255	Sum	0.1336	Sum	0.0919	Sum	0.2567
Count	410.0000	Count	410.0000	Count	410.0000	Count	410.0000	Count	409.0000
Largest(1)	0.0290	Largest(1)	0.0440	Largest(1)	0.0210	Largest(1)	0.0399	Largest(1)	0.0491
Smallest(1)	-0.0373	Smallest(1)	-0.0370	Smallest(1)	-0.0195	Smallest(1)	-0.0376	Smallest(1)	-0.0391
Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0009	Confidence Level(95.0%)	0.0005	Confidence Level(95.0%)	0.0008	Confidence Level(95.0%)	0.0010

Appendix 2: Day-of-the-week Model

DJIA

Close-to-close

With all days

Regression Statistics	
Multiple R	0.0687
R Square	0.0047
Adjusted R Square	0.0031
Standard Error	0.0089
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	0.0009	0.0002	2.9939	0.0177
Residual	2522.0000	0.1994	0.0001		
Total	2526.0000	0.2003			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0016	0.0004	3.8411	0.0001	0.0008	0.0023
Tuesday	-0.0009	0.0006	-1.5262	0.1271	-0.0020	0.0002
Wednesday	-0.0011	0.0006	-1.9236	0.0545	-0.0022	0.0000
Thursday	-0.0019	0.0006	-3.4318	0.0006	-0.0030	-0.0008
Friday	-0.0011	0.0006	-1.8685	0.0618	-0.0022	0.0001

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0695
R Square	0.0048
Adjusted R Square	0.0025
Standard Error	0.0089
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	0.0010	0.0002	2.0386	0.0574
Residual	2520.0000	0.1994	0.0001		
Total	2526.0000	0.2003			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0015	0.0004	3.6856	0.0002	0.0007	0.0023
Tuesday	-0.0009	0.0006	-1.5306	0.1260	-0.0020	0.0002
Wednesday	-0.0011	0.0006	-1.9045	0.0570	-0.0022	0.0000
Thursday	-0.0019	0.0006	-3.4203	0.0006	-0.0030	-0.0008
Friday	-0.0011	0.0006	-1.8809	0.0601	-0.0022	0.0000
January	0.0003	0.0006	0.3997	0.6894	-0.0010	0.0015
Pre-Post Holiday	0.0002	0.0007	0.3271	0.7436	-0.0011	0.0016

Close-to-Open

With all days

Regression Statistics	
Multiple R	0.0444
R Square	0.0020
Adjusted R Square	0.0004
Standard Error	0.0049
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	0.0001	0.0000	1.2482	0.2884
Residual	2522.0000	0.0601	0.0000		
Total	2526.0000	0.0602			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0000	0.0002	-0.1331	0.8941	-0.0005	0.0004
Tuesday	0.0005	0.0003	1.4792	0.1392	-0.0001	0.0011
Wednesday	0.0001	0.0003	0.4576	0.6473	-0.0005	0.0007
Thursday	0.0002	0.0003	0.5149	0.6067	-0.0004	0.0008
Friday	0.0006	0.0003	1.8916	0.0587	0.0000	0.0012

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0515
R Square	0.0027
Adjusted R Square	0.0003
Standard Error	0.0049
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	0.0002	0.0000	1.1176	0.3493
Residual	2520.0000	0.0601	0.0000		
Total	2526.0000	0.0602			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0000	0.0002	-0.0349	0.9722	-0.0005	0.0004
Tuesday	0.0005	0.0003	1.4723	0.1411	-0.0002	0.0011
Wednesday	0.0001	0.0003	0.4839	0.6285	-0.0005	0.0008
Thursday	0.0002	0.0003	0.5341	0.5933	-0.0004	0.0008
Friday	0.0006	0.0003	1.8791	0.0603	0.0000	0.0012
January	-0.0004	0.0004	-1.2224	0.2217	-0.0011	0.0003
Pre-Post Holiday	0.0002	0.0004	0.4569	0.6478	-0.0006	0.0009

Open-to-Close

With all days

Regression Statistics	
Multiple R	0.0869
R Square	0.0076
Adjusted R Square	0.0060
Standard Error	0.0079
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	0.0012	0.0003	4.7967	0.0007
Residual	2522.0000	0.1579	0.0001		
Total	2526.0000	0.1591			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0016	0.0004	4.3984	0.0000	0.0009	0.0023
Tuesday	-0.0013	0.0005	-2.6276	0.0087	-0.0023	-0.0003
Wednesday	-0.0012	0.0005	-2.4439	0.0146	-0.0022	-0.0002
Thursday	-0.0021	0.0005	-4.1740	0.0000	-0.0031	-0.0011
Friday	-0.0016	0.0005	-3.2666	0.0011	-0.0026	-0.0007

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0901
R Square	0.0081
Adjusted R Square	0.0058
Standard Error	0.0079
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	0.0013	0.0002	3.4394	0.0022
Residual	2520.0000	0.1578	0.0001		
Total	2526.0000	0.1591			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0015	0.0004	4.1640	0.0000	0.0008	0.0022
Tuesday	-0.0013	0.0005	-2.6286	0.0086	-0.0023	-0.0003
Wednesday	-0.0012	0.0005	-2.4392	0.0148	-0.0022	-0.0002
Thursday	-0.0021	0.0005	-4.1739	0.0000	-0.0031	-0.0011
Friday	-0.0017	0.0005	-3.2734	0.0011	-0.0026	-0.0007
January	0.0007	0.0006	1.2034	0.2289	-0.0004	0.0018
Pre-Post Holiday	0.0001	0.0006	0.0858	0.9316	-0.0012	0.0013

Open-to-Open

With all days

Regression Statistics	
Multiple R	0.0729
R Square	0.0053
Adjusted R Square	0.0037
Standard Error	0.0098
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	0.0013	0.0003	3.3661	0.0093
Residual	2522.0000	0.2414	0.0001		
Total	2526.0000	0.2427			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0020	0.0004	4.4277	0.0000	0.0011	0.0028
Tuesday	-0.0016	0.0006	-2.5164	0.0119	-0.0028	-0.0003
Wednesday	-0.0015	0.0006	-2.3817	0.0173	-0.0027	-0.0003
Thursday	-0.0019	0.0006	-3.1276	0.0018	-0.0032	-0.0007
Friday	-0.0020	0.0006	-3.1961	0.0014	-0.0032	-0.0008

Without Pre/Post Holidays

Regression Statistics	
Multiple R	0.0742
R Square	0.0055
Adjusted R Square	0.0031
Standard Error	0.0098
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	0.0013	0.0002	2.3277	0.0303
Residual	2520.0000	0.2414	0.0001		
Total	2526.0000	0.2427			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0019	0.0005	4.3016	0.0000	0.0011	0.0028
Tuesday	-0.0016	0.0006	-2.5125	0.0120	-0.0028	-0.0003
Wednesday	-0.0015	0.0006	-2.3921	0.0168	-0.0027	-0.0003
Thursday	-0.0020	0.0006	-3.1356	0.0017	-0.0032	-0.0007
Friday	-0.0020	0.0006	-3.1872	0.0015	-0.0032	-0.0008
January	0.0005	0.0007	0.6703	0.5027	-0.0009	0.0019
Pre-Post Holiday	-0.0002	0.0008	-0.2426	0.8084	-0.0017	0.0013

SP 500 Index

Close-to-Close

With all days

Regression Statistics	
Multiple R	0.0541
R Square	0.0029
Adjusted R Square	0.0013
Standard Error	0.0089
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	0.0006	0.0001	1.8474	0.1170
Residual	2522.0000	0.2004	0.0001		
Total	2526.0000	0.2010			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0011	0.0004	2.8012	0.0051	0.0003	0.0019
Tuesday	-0.0005	0.0006	-0.8874	0.3749	-0.0016	0.0006
Wednesday	-0.0003	0.0006	-0.6091	0.5425	-0.0015	0.0008
Thursday	-0.0015	0.0006	-2.5750	0.0101	-0.0026	-0.0003
Friday	-0.0006	0.0006	-1.0096	0.3128	-0.0017	0.0005

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0548
R Square	0.0030
Adjusted R Square	0.0006
Standard Error	0.0089
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	0.0006	0.0001	1.2640	0.2706
Residual	2520.0000	0.2004	0.0001		
Total	2526.0000	0.2010			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0011	0.0004	2.6805	0.0074	0.0003	0.0019
Tuesday	-0.0005	0.0006	-0.8974	0.3696	-0.0016	0.0006
Wednesday	-0.0003	0.0006	-0.6114	0.5410	-0.0015	0.0008
Thursday	-0.0015	0.0006	-2.5570	0.0106	-0.0026	-0.0003
Friday	-0.0006	0.0006	-1.0022	0.3164	-0.0017	0.0005
January	0.0003	0.0006	0.4066	0.6843	-0.0010	0.0015
Pre-Post Holiday	0.0001	0.0007	0.1872	0.8515	-0.0012	0.0015

SP 500 Index Futures

Close-to-Close

With all days

Regression Statistics	
Multiple R	0.0517
R Square	0.0027
Adjusted R Square	0.0011
Standard Error	0.9538
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	6.1391	1.5348	1.6870	0.1502
Residual	2522.0000	2294.5045	0.9098		
Total	2526.0000	2300.6436			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.1107	0.0434	2.5481	0.0109	0.0255	0.1959	0.0255	0.1959
X Variable 1	-0.0584	0.0604	-0.9671	0.3336	-0.1768	0.0600	-0.1768	0.0600
X Variable 2	-0.0463	0.0604	-0.7655	0.4440	-0.1647	0.0722	-0.1647	0.0722
X Variable 3	-0.1520	0.0607	-2.5068	0.0122	-0.2710	-0.0331	-0.2710	-0.0331
X Variable 4	-0.0761	0.0608	-1.2509	0.2111	-0.1953	0.0432	-0.1953	0.0432

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0517
R Square	0.0027
Adjusted R Square	0.0003
Standard Error	0.9542
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	6.1526	1.0254	1.1262	0.3442
Residual	2520.0000	2294.4909	0.9105		
Total	2526.0000	2300.6436			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.1101	0.0442	2.4916	0.0128	0.0234	0.1967	0.0234	0.1967
X Variable 1	-0.0584	0.0604	-0.9665	0.3339	-0.1768	0.0601	-0.1768	0.0601
X Variable 2	-0.0463	0.0605	-0.7650	0.4443	-0.1650	0.0724	-0.1650	0.0724
X Variable 3	-0.1521	0.0607	-2.5054	0.0123	-0.2711	-0.0331	-0.2711	-0.0331
X Variable 4	-0.0761	0.0609	-1.2498	0.2115	-0.1954	0.0433	-0.1954	0.0433
X Variable 5	0.0084	0.0688	0.1214	0.9034	-0.1265	0.1432	-0.1265	0.1432
X Variable 6	-0.0007	0.0750	-0.0091	0.9927	-0.1477	0.1463	-0.1477	0.1463

Close-to-Open

With all days

Regression Statistics	
Multiple R	0.0352
R Square	0.0012
Adjusted R Square	-0.0003
Standard Error	0.4356
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	0.5950	0.1488	0.7838	0.5356
Residual	2522.0000	478.6278	0.1898		
Total	2526.0000	479.2229			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0121	0.0198	0.6099	0.5420	-0.0268	0.0510	-0.0268	0.0510
X Variable 1	0.0131	0.0276	0.4746	0.6351	-0.0410	0.0671	-0.0410	0.0671
X Variable 2	0.0033	0.0276	0.1210	0.9037	-0.0508	0.0575	-0.0508	0.0575
X Variable 3	-0.0276	0.0277	-0.9956	0.3195	-0.0819	0.0267	-0.0819	0.0267
X Variable 4	0.0152	0.0278	0.5469	0.5845	-0.0393	0.0696	-0.0393	0.0696

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0413
R Square	0.0017
Adjusted R Square	-0.0007
Standard Error	0.4357
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	0.8172	0.1362	0.7174	0.6356
Residual	2520.0000	478.4057	0.1898		
Total	2526.0000	479.2229			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0083	0.0202	0.4103	0.6817	-0.0313	0.0478	-0.0313	0.0478
X Variable 1	0.0127	0.0276	0.4605	0.6452	-0.0414	0.0668	-0.0414	0.0668
X Variable 2	0.0046	0.0276	0.1666	0.8677	-0.0496	0.0588	-0.0496	0.0588
X Variable 3	-0.0268	0.0277	-0.9686	0.3329	-0.0812	0.0275	-0.0812	0.0275
X Variable 4	0.0141	0.0278	0.5088	0.6110	-0.0404	0.0686	-0.0404	0.0686
X Variable 5	0.0183	0.0314	0.5830	0.5599	-0.0433	0.0799	-0.0433	0.0799
X Variable 6	0.0314	0.0342	0.9166	0.3594	-0.0357	0.0985	-0.0357	0.0985

Open-to-Close

With all days

Multiple R	0.0479
R Square	0.0023
Adjusted R Square	0.0007
Standard Error	0.8613
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	4.3008	1.0752	1.4494	0.2151
Residual	2522.0000	1870.8541	0.7418		
Total	2526.0000	1875.1549			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0986	0.0392	2.5134	0.0120	0.0217	0.1755	0.0217	0.1755
X Variable 1	-0.0715	0.0545	-1.3111	0.1899	-0.1784	0.0354	-0.1784	0.0354
X Variable 2	-0.0496	0.0546	-0.9090	0.3635	-0.1566	0.0574	-0.1566	0.0574
X Variable 3	-0.1245	0.0548	-2.2726	0.0231	-0.2319	-0.0171	-0.2319	-0.0171
X Variable 4	-0.0912	0.0549	-1.6620	0.0966	-0.1989	0.0164	-0.1989	0.0164

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0489
R Square	0.0024
Adjusted R Square	0.0000
Standard Error	0.8616
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	4.4854	0.7476	1.0071	0.4187
Residual	2520.0000	1870.6695	0.7423		
Total	2526.0000	1875.1549			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.1018	0.0399	2.5519	0.0108	0.0236	0.1800	0.0236	0.1800
X Variable 1	-0.0711	0.0545	-1.3033	0.1926	-0.1780	0.0359	-0.1780	0.0359
X Variable 2	-0.0509	0.0547	-0.9315	0.3517	-0.1581	0.0563	-0.1581	0.0563
X Variable 3	-0.1252	0.0548	-2.2849	0.0224	-0.2327	-0.0178	-0.2327	-0.0178
X Variable 4	-0.0902	0.0550	-1.6415	0.1008	-0.1980	0.0176	-0.1980	0.0176
X Variable 5	-0.0100	0.0621	-0.1603	0.8726	-0.1317	0.1118	-0.1317	0.1118
X Variable 6	-0.0321	0.0677	-0.4736	0.6358	-0.1648	0.1007	-0.1648	0.1007

Open-to-Open

With all days

Regression Statistics	
Multiple R	0.0388
R Square	0.0015
Adjusted R Square	-0.0001
Standard Error	0.9872
Observations	2526.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4.0000	3.6971	0.9243	0.9483	0.4349
Residual	2521.0000	2457.0054	0.9746		
Total	2525.0000	2460.7025			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0203	0.0450	0.4524	0.6510	-0.0678	0.1085	-0.0678	0.1085
X Variable 1	0.0940	0.0625	1.5042	0.1327	-0.0285	0.2165	-0.0285	0.2165
X Variable 2	0.0248	0.0625	0.3961	0.6920	-0.0979	0.1474	-0.0979	0.1474
X Variable 3	0.0151	0.0628	0.2408	0.8097	-0.1080	0.1382	-0.1080	0.1382
X Variable 4	-0.0170	0.0630	-0.2695	0.7876	-0.1404	0.1065	-0.1404	0.1065

Without January and Pre/Post Holidays

Regression Statistics	
Multiple R	0.0440
R Square	0.0019
Adjusted R Square	-0.0004
Standard Error	0.9874
Observations	2526.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.0000	4.7653	0.7942	0.8146	0.5584
Residual	2519.0000	2455.9371	0.9750		
Total	2525.0000	2460.7025			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0274	0.0457	0.5984	0.5496	-0.0623	0.1170	-0.0623	0.1170
X Variable 1	0.0950	0.0625	1.5194	0.1288	-0.0276	0.2175	-0.0276	0.2175
X Variable 2	0.0215	0.0626	0.3426	0.7319	-0.1014	0.1443	-0.1014	0.1443
X Variable 3	0.0131	0.0628	0.2089	0.8345	-0.1101	0.1363	-0.1101	0.1363
X Variable 4	-0.0144	0.0630	-0.2290	0.8189	-0.1380	0.1091	-0.1380	0.1091
X Variable 5	-0.0127	0.0712	-0.1787	0.8582	-0.1523	0.1268	-0.1523	0.1268
X Variable 6	-0.0801	0.0776	-1.0330	0.3017	-0.2323	0.0720	-0.2323	0.0720

Appendix 3: Monday Model

DJIA

Close-to-Close

Regression Statistics	
Multiple R	0.0544
R Square	0.0030
Adjusted R Square	0.0026
Standard Error	0.0089
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0006	0.0006	7.5009	0.0062
Residual	2525.0000	0.1997	0.0001		
Total	2526.0000	0.2003			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0016	0.0004	3.8400	0.0001	0.0008	0.0024	0.0008	0.0024
X Variable 1	-0.0012	0.0005	-2.7388	0.0062	-0.0021	-0.0004	-0.0021	-0.0004

Close-to-Open

Regression Statistics	
Multiple R	0.0270
R Square	0.0007
Adjusted R Square	0.0003
Standard Error	0.0049
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0000	0.0000	1.8470	0.1743
Residual	2525.0000	0.0602	0.0000		
Total	2526.0000	0.0602			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0000	0.0002	-0.1331	0.8941	-0.0005	0.0004	-0.0005	0.0004
X Variable 1	0.0003	0.0002	1.3590	0.1743	-0.0001	0.0008	-0.0001	0.0008

Open-to-Close

Regression Statistics	
Multiple R	0.0777
R Square	0.0060
Adjusted R Square	0.0056
Standard Error	0.0079
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0010	0.0010	15.3377	0.0001
Residual	2525.0000	0.1581	0.0001		
Total	2526.0000	0.1591			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0016	0.0004	4.3976	0.0000	0.0009	0.0023	0.0009	0.0023
X Variable 1	-0.0016	0.0004	-3.9163	0.0001	-0.0024	-0.0008	-0.0024	-0.0008

Open-to-Open

Regression Statistics	
Multiple R	0.0698
R Square	0.0049
Adjusted R Square	0.0045
Standard Error	0.0098
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0012	0.0012	12.3540	0.0004
Residual	2525.0000	0.2416	0.0001		
Total	2526.0000	0.2427			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0020	0.0004	4.4294	0.0000	0.0011	0.0028	0.0011	0.0028
X Variable 1	-0.0017	0.0005	-3.5148	0.0004	-0.0027	-0.0008	-0.0027	-0.0008

SP 500 Index

Close-to-Close

Regression Statistics	
Multiple R	0.0316
R Square	0.0010
Adjusted R Square	0.0006
Standard Error	0.0089
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0002	0.0002	2.5235	0.1123
Residual	2525.0000	0.2008	0.0001		
Total	2526.0000	0.2010			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Monday	0.0011	0.0004	2.8002	0.0051	0.0003	0.0019	0.0003	0.0019
X Variable 1	-0.0007	0.0005	-1.5886	0.1123	-0.0016	0.0002	-0.0016	0.0002

SP 500 Futures

Close-to-Close

Regression Statistics	
Multiple R	0.0341
R Square	0.0012
Adjusted R Square	0.0008
Standard Error	0.9540
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	2.6828	2.6828	2.9479	0.0861
Residual	2525.0000	2297.9608	0.9101		
Total	2526.0000	2300.6436			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.1107	0.0435	2.5477	0.0109	0.0255	0.1959	0.0255	0.1959
X Variable 1	-0.0829	0.0483	-1.7169	0.0861	-0.1777	0.0118	-0.1777	0.0118

Close-to-Open

Regression Statistics	
Multiple R	0.0009
R Square	0.0000
Adjusted R Square	-0.0004
Standard Error	0.4357
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0004	0.0004	0.0022	0.9624
Residual	2525.0000	479.2224	0.1898		
Total	2526.0000	479.2229			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0121	0.0198	0.6098	0.5420	-0.0268	0.0510	-0.0268	0.0510
X Variable 1	0.0010	0.0221	0.0472	0.9624	-0.0422	0.0443	-0.0422	0.0443

Open-to-Close

Regression Statistics	
Multiple R	0.0383
R Square	0.0015
Adjusted R Square	0.0011
Standard Error	0.8611
Observations	2527.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	2.7506	2.7506	3.7093	0.0542
Residual	2525.0000	1872.4043	0.7415		
Total	2526.0000	1875.1549			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0986	0.0392	2.5138	0.0120	0.0217	0.1755	0.0217	0.1755
X Variable 1	-0.0840	0.0436	-1.9260	0.0542	-0.1695	0.0015	-0.1695	0.0015

Open-to-Open

Regression Statistics	
Multiple R	0.0118
R Square	0.0001
Adjusted R Square	-0.0003
Standard Error	0.9873
Observations	2526.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.3431	0.3431	0.3520	0.5530
Residual	2524.0000	2460.3593	0.9748		
Total	2525.0000	2460.7025			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0203	0.0450	0.4524	0.6510	-0.0678	0.1085	-0.0678	0.1085
X Variable 1	0.0297	0.0500	0.5933	0.5530	-0.0684	0.1277	-0.0684	0.1277

Appendix 4: ARMA-GARCH Models

ARMA Analysis

EGARCH

Dow Jones Close-to-Close: AR(0)MA(0)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:08
Sample: 1 2527
Included observations: 2527
Convergence achieved after 51 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.142236	0.032305	4.402881	0.0000
SER04	-0.138843	0.045749	-3.034900	0.0024
SER05	-0.074852	0.046796	-1.599515	0.1097
SER06	-0.149155	0.045091	-3.307840	0.0009
SER07	-0.115724	0.043001	-2.691170	0.0071
	Variance Equation			
C	-0.097419	0.009103	-10.70125	0.0000
|RES|/SQR[GARCH](1)	0.118271	0.011190	10.56954	0.0000
RES/SQR[GARCH](1)	-0.072381	0.007650	-9.461982	0.0000
EGARCH(1)	0.979610	0.003147	311.2715	0.0000

R-squared	0.003349	Mean dependent var	0.055752
Adjusted R-squared	0.000182	S.D. dependent var	0.891664
S.E. of regression	0.891583	Akaike info criterion	2.430884
Sum squared resid	2001.609	Schwarz criterion	2.451665
Log likelihood	-3062.422	F-statistic	1.057499
Durbin-Watson stat	1.938921	Prob(F-statistic)	0.390251

EGARCH

Dow Jones Close-to-close: AR(0)MA(1)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:08
Sample: 1 2527
Included observations: 2527
Convergence achieved after 51 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.142236	0.032305	4.402881	0.0000
SER04	-0.138843	0.045749	-3.034900	0.0024
SER05	-0.074852	0.046796	-1.599515	0.1097
SER06	-0.149155	0.045091	-3.307840	0.0009
SER07	-0.115724	0.043001	-2.691170	0.0071
Variance Equation				
C	-0.097419	0.009103	-10.70125	0.0000
|RES|/SQR[GARCH](1)	0.118271	0.011190	10.56954	0.0000
RES/SQR[GARCH](1)	-0.072381	0.007650	-9.461982	0.0000
EGARCH(1)	0.979610	0.003147	311.2715	0.0000

R-squared	0.003349	Mean dependent var	0.055752
Adjusted R-squared	0.000182	S.D. dependent var	0.891664
S.E. of regression	0.891583	Akaike info criterion	2.430884
Sum squared resid	2001.609	Schwarz criterion	2.451665
Log likelihood	-3062.422	F-statistic	1.057499
Durbin-Watson stat	1.938921	Prob(F-statistic)	0.390251

EGARCH

DJIA CC: AR(0)MA(2)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:30
Sample: 1 2527
Included observations: 2527
Convergence achieved after 60 iterations
Backcast: 0

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.144706	0.032022	4.518970	0.0000
SER04	-0.146603	0.044895	-3.265427	0.0011
SER05	-0.083870	0.046155	-1.817149	0.0692
SER06	-0.154621	0.044278	-3.492067	0.0005
SER07	-0.115000	0.042002	-2.737953	0.0062
MA(1)	0.049774	0.021632	2.300968	0.0214
	Variance Equation			
C	-0.100079	0.009333	-10.72342	0.0000
|RES|/SQR[GARCH](1)	0.120797	0.011466	10.53552	0.0000
RES/SQR[GARCH](1)	-0.077663	0.008108	-9.578907	0.0000
EGARCH(1)	0.978247	0.003305	295.9830	0.0000

R-squared	0.003935	Mean dependent var	0.055752
Adjusted R-squared	0.000373	S.D. dependent var	0.891664
S.E. of regression	0.891498	Akaike info criterion	2.429206
Sum squared resid	2000.431	Schwarz criterion	2.452296
Log likelihood	-3059.302	F-statistic	1.104848
Durbin-Watson stat	2.037053	Prob(F-statistic)	0.355541
Inverted MA Roots	-.05		

EGARCH

DJIA CC: AR(1) MA(0)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:13
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 61 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.144827	0.032003	4.525444	0.0000
SER04	-0.146470	0.044818	-3.268105	0.0011
SER05	-0.085330	0.046108	-1.850664	0.0642
SER06	-0.155696	0.044188	-3.523506	0.0004
SER07	-0.115630	0.042000	-2.753075	0.0059
AR(1)	0.053471	0.021676	2.466810	0.0136
	Variance Equation			
C	-0.099741	0.009323	-10.69829	0.0000
|RES|/SQR[GARCH](1)	0.120301	0.011459	10.49869	0.0000
RES/SQR[GARCH](1)	-0.077193	0.008160	-9.459608	0.0000
EGARCH(1)	0.978399	0.003296	296.8053	0.0000

R-squared	0.003735	Mean dependent var	0.055780
Adjusted R-squared	0.000171	S.D. dependent var	0.891839
S.E. of regression	0.891763	Akaike info criterion	2.428948
Sum squared resid	2000.828	Schwarz criterion	2.452046
Log likelihood	-3057.762	F-statistic	1.047937
Durbin-Watson stat	2.043902	Prob(F-statistic)	0.398838
Inverted AR Roots	.05		

EGARCH

DJIA CC: AR(1) MA(1)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:16
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 65 iterations
Backcast: 1

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.143814	0.032023	4.490918	0.0000
SER04	-0.143745	0.044366	-3.239960	0.0012
SER05	-0.085125	0.045864	-1.856022	0.0635
SER06	-0.156818	0.043969	-3.566590	0.0004
SER07	-0.115717	0.042114	-2.747708	0.0060
AR(1)	0.233936	0.341028	0.685974	0.4927
MA(1)	-0.179357	0.345259	-0.519485	0.6034
	Variance Equation			
C	-0.100126	0.009603	-10.42635	0.0000
|RES|/SQR[GARCH](1)	0.120670	0.011937	10.10872	0.0000
RES/SQR[GARCH](1)	-0.078512	0.008290	-9.470707	0.0000
EGARCH(1)	0.978258	0.003372	290.0872	0.0000

R-squared	0.003180	Mean dependent var	0.055780
Adjusted R-squared	-0.000783	S.D. dependent var	0.891839
S.E. of regression	0.892189	Akaike info criterion	2.429509
Sum squared resid	2001.942	Schwarz criterion	2.454916
Log likelihood	-3057.470	F-statistic	0.802354
Durbin-Watson stat	2.044544	Prob(F-statistic)	0.626542

Inverted AR Roots	.23
Inverted MA Roots	.18

EGARCH

DJIA C-C: AR(2) MA(0)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:21
Sample(adjusted): 3 2527
Included observations: 2525 after adjusting endpoints
Convergence achieved after 51 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.142484	0.032069	4.442972	0.0000
SER04	-0.141605	0.044454	-3.185402	0.0014
SER05	-0.083249	0.045655	-1.823424	0.0682
SER06	-0.155295	0.043804	-3.545226	0.0004
SER07	-0.113065	0.042213	-2.678418	0.0074
AR(1)	0.052628	0.021737	2.421109	0.0155
AR(2)	0.021346	0.020746	1.028945	0.3035
	Variance Equation			
C	-0.100419	0.009604	-10.45595	0.0000
|RES|/SQR[GARCH](1)	0.120800	0.011915	10.13867	0.0000
RES/SQR[GARCH](1)	-0.078509	0.008442	-9.300210	0.0000
EGARCH(1)	0.978219	0.003372	290.1297	0.0000

R-squared	0.002658	Mean dependent var	0.055995
Adjusted R-squared	-0.001309	S.D. dependent var	0.891951
S.E. of regression	0.892534	Akaike info criterion	2.429208
Sum squared resid	2002.697	Schwarz criterion	2.454623
Log likelihood	-3055.875	F-statistic	0.669933
Durbin-Watson stat	2.039453	Prob(F-statistic)	0.753333

Inverted AR Roots	.17	-.12

EGARCH

DJIA C-C: AR(2) MA (1)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:22
Sample(adjusted): 3 2527
Included observations: 2525 after adjusting endpoints
Convergence achieved after 59 iterations
Backcast: 2

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.143472	0.032743	4.381805	0.0000
SER04	-0.143025	0.044371	-3.223399	0.0013
SER05	-0.082341	0.046139	-1.784613	0.0743
SER06	-0.155401	0.043838	-3.544930	0.0004
SER07	-0.113251	0.042087	-2.690889	0.0071
AR(1)	0.993887	0.052609	18.89203	0.0000
AR(2)	-0.044955	0.021715	-2.070206	0.0384
MA(1)	-0.941996	0.048428	-19.45154	0.0000
	Variance Equation			
C	-0.094612	0.009595	-9.860301	0.0000
|RES|/SQR[GARCH](1)	0.114475	0.011816	9.688415	0.0000
RES/SQR[GARCH](1)	-0.078389	0.008479	-9.245027	0.0000
EGARCH(1)	0.980229	0.003165	309.7437	0.0000

R-squared	0.004348	Mean dependent var	0.055995
Adjusted R-squared	-0.000010	S.D. dependent var	0.891951
S.E. of regression	0.891955	Akaike info criterion	2.429280
Sum squared resid	1999.302	Schwarz criterion	2.457006
Log likelihood	-3054.966	F-statistic	0.997748
Durbin-Watson stat	2.041952	Prob(F-statistic)	0.445702

Inverted AR Roots	.95	.05
Inverted MA Roots	.94	

EGARCH

DJIA C_C: AR(2)MA(2)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:26
Sample(adjusted): 3 2527
Included observations: 2525 after adjusting endpoints
Convergence achieved after 59 iterations
Backcast: 1 2

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.144985	0.032575	4.450813	0.0000
SER04	-0.141493	0.045883	-3.083788	0.0020
SER05	-0.081081	0.047456	-1.708533	0.0875
SER06	-0.157037	0.046978	-3.342796	0.0008
SER07	-0.113668	0.043271	-2.626888	0.0086
AR(1)	0.277069	0.027556	10.05485	0.0000
AR(2)	-0.950750	0.026740	-35.55573	0.0000
MA(1)	-0.260597	0.025932	-10.04912	0.0000
MA(2)	0.955606	0.024655	38.75885	0.0000
	Variance Equation			
C	-0.100659	0.009707	-10.37004	0.0000
|RES|/SQR[GARCH](1)	0.121447	0.011934	10.17645	0.0000
RES/SQR[GARCH](1)	-0.071579	0.008198	-8.730877	0.0000
EGARCH(1)	0.978682	0.003381	289.4975	0.0000

R-squared	0.007508	Mean dependent var	0.055995
Adjusted R-squared	0.002767	S.D. dependent var	0.891951
S.E. of regression	0.890716	Akaike info criterion	2.429798
Sum squared resid	1992.957	Schwarz criterion	2.459834
Log likelihood	-3054.620	F-statistic	1.583622
Durbin-Watson stat	1.972925	Prob(F-statistic)	0.089265

Inverted AR Roots	.14+.97i	.14 -.97i
Inverted MA Roots	.13 -.97i	.13+.97i

EGarch

DJIA Close-to-Open (CO) : AR(1) MA (0)

Dependent Variable: SER02
Method: ML – ARCH
Date: 07/24/05 Time: 19:45
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence not achieved after 500 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.020619	0.016196	-1.273128	0.2030
SER04	0.036305	0.025010	1.451613	0.1466
SER05	0.033887	0.025116	1.349226	0.1773
SER06	0.070492	0.024898	2.831194	0.0046
SER07	0.046788	0.023286	2.009279	0.0445
AR(1)	-0.027381	0.020766	-1.318551	0.1873
	Variance Equation			
C	-0.085221	0.004768	-17.87391	0.0000
|RES|/SQR[GARCH](1)	0.095213	0.005361	17.76031	0.0000
RES/SQR[GARCH](1)	-0.026929	0.004425	-6.085311	0.0000
EGARCH(1)	0.987357	0.001519	649.8379	0.0000

R-squared	0.001166	Mean dependent var	0.025792
Adjusted R-squared	-0.002407	S.D. dependent var	0.483439
S.E. of regression	0.484021	Akaike info criterion	1.210438
Sum squared resid	589.4383	Schwarz criterion	1.233535
Log likelihood	-1518.783	F-statistic	0.326418
Durbin-Watson stat	2.054766	Prob(F-statistic)	0.966621
Inverted AR Roots	-.03		

EGarch

DJIA Open-to-Close (OP): AR(1) MA (0)

Dependent Variable: SER03
Method: ML – ARCH
Date: 07/24/05 Time: 19:46
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 105 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.153954	0.029866	5.154857	0.0000
SER04	-0.164900	0.040030	-4.119397	0.0000
SER05	-0.118100	0.042248	-2.795429	0.0052
SER06	-0.191342	0.042988	-4.451111	0.0000
SER07	-0.158766	0.041554	-3.820686	0.0001
AR(1)	0.002201	0.020583	0.106919	0.9149
	Variance Equation			
C	-0.117848	0.010035	-11.74389	0.0000
|RES|/SQR[GARCH](1)	0.134026	0.011707	11.44817	0.0000
RES/SQR[GARCH](1)	-0.066894	0.007305	-9.157726	0.0000
EGARCH(1)	0.973185	0.003865	251.7966	0.0000

R-squared	0.006996	Mean dependent var	0.029989
Adjusted R-squared	0.003444	S.D. dependent var	0.798311
S.E. of regression	0.796935	Akaike info criterion	2.229670
Sum squared resid	1597.926	Schwarz criterion	2.252767
Log likelihood	-2806.073	F-statistic	1.969623
Durbin-Watson stat	2.090223	Prob(F-statistic)	0.038958
Inverted AR Roots	.00		

GARCH

DJIA CC: AR(1) MA (0)

Dependent Variable: SER01
Method: ML – ARCH
Date: 07/24/05 Time: 19:35
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 35 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.144654	0.033203	4.356682	0.0000
SER04	-0.119283	0.046798	-2.548883	0.0108
SER05	-0.065748	0.049337	-1.332612	0.1827
SER06	-0.128166	0.046240	-2.771753	0.0056
SER07	-0.086628	0.044666	-1.939440	0.0524
AR(1)	0.052099	0.021700	2.400831	0.0164
	Variance Equation			
C	0.008116	0.001843	4.402921	0.0000
ARCH(1)	0.051469	0.004675	11.00827	0.0000
GARCH(1)	0.938816	0.006194	151.5602	0.0000

R-squared	0.003877	Mean dependent var	0.055780
Adjusted R-squared	0.000711	S.D. dependent var	0.891839
S.E. of regression	0.891522	Akaike info criterion	2.451334
Sum squared resid	2000.543	Schwarz criterion	2.472121
Log likelihood	-3087.034	F-statistic	1.224504
Durbin-Watson stat	2.040848	Prob(F-statistic)	0.280173
Inverted AR Roots	.05		

EGARCH AR(1) – Best Fit Model

Day of the Week Model

DJIA Close-to-Close

Dependent Variable: DJIA Close-to-Close (Day of Week Model)
Method: ML - ARCH
Date: 07/24/05 Time: 19:13
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 61 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.144827	0.032003	4.525444	0.0000
SER04	-0.146470	0.044818	-3.268105	0.0011
SER05	-0.085330	0.046108	-1.850664	0.0642
SER06	-0.155696	0.044188	-3.523506	0.0004
SER07	-0.115630	0.042000	-2.753075	0.0059
AR(1)	0.053471	0.021676	2.466810	0.0136
	Variance Equation			
C	-0.099741	0.009323	-10.69829	0.0000
|RES|/SQR[GARCH](1)	0.120301	0.011459	10.49869	0.0000
RES/SQR[GARCH](1)	-0.077193	0.008160	-9.459608	0.0000
EGARCH(1)	0.978399	0.003296	296.8053	0.0000

R-squared	0.003735	Mean dependent var	0.055780
Adjusted R-squared	0.000171	S.D. dependent var	0.891839
S.E. of regression	0.891763	Akaike info criterion	2.428948
Sum squared resid	2000.828	Schwarz criterion	2.452046
Log likelihood	-3057.762	F-statistic	1.047937
Durbin-Watson stat	2.043902	Prob(F-statistic)	0.398838
Inverted AR Roots	.05		

DJIA Close-to-Open

DJIA Close-to-Open (Day of Week Model)
Method: ML - ARCH
Date: 07/24/05 Time: 19:45
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence not achieved after 500 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.020619	0.016196	-1.273128	0.2030
SER04	0.036305	0.025010	1.451613	0.1466
SER05	0.033887	0.025116	1.349226	0.1773
SER06	0.070492	0.024898	2.831194	0.0046
SER07	0.046788	0.023286	2.009279	0.0445
AR(1)	-0.027381	0.020766	-1.318551	0.1873
Variance Equation				
C	-0.085221	0.004768	-17.87391	0.0000
|RES|/SQR[GARCH](1)	0.095213	0.005361	17.76031	0.0000
RES/SQR[GARCH](1)	-0.026929	0.004425	-6.085311	0.0000
EGARCH(1)	0.987357	0.001519	649.8379	0.0000

R-squared	0.001166	Mean dependent var	0.025792
Adjusted R-squared	-0.002407	S.D. dependent var	0.483439
S.E. of regression	0.484021	Akaike info criterion	1.210438
Sum squared resid	589.4383	Schwarz criterion	1.233535
Log likelihood	-1518.783	F-statistic	0.326418
Durbin-Watson stat	2.054766	Prob(F-statistic)	0.966621
Inverted AR Roots	-.03		

DJIA Open-to-Close

DJIA Open-to-Close (Day of Week Model)
Method: ML - ARCH
Date: 07/24/05 Time: 19:46
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 105 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.153954	0.029866	5.154857	0.0000
SER04	-0.164900	0.040030	-4.119397	0.0000
SER05	-0.118100	0.042248	-2.795429	0.0052
SER06	-0.191342	0.042988	-4.451111	0.0000
SER07	-0.158766	0.041554	-3.820686	0.0001
AR(1)	0.002201	0.020583	0.106919	0.9149
		Variance Equation		
C	-0.117848	0.010035	-11.74389	0.0000
|RES|/SQR[GARCH](1)	0.134026	0.011707	11.44817	0.0000
RES/SQR[GARCH](1)	-0.066894	0.007305	-9.157726	0.0000
EGARCH(1)	0.973185	0.003865	251.7966	0.0000

R-squared	0.006996	Mean dependent var	0.029989
Adjusted R-squared	0.003444	S.D. dependent var	0.798311
S.E. of regression	0.796935	Akaike info criterion	2.229670
Sum squared resid	1597.926	Schwarz criterion	2.252767
Log likelihood	-2806.073	F-statistic	1.969623
Durbin-Watson stat	2.090223	Prob(F-statistic)	0.038958

Inverted AR Roots	.00

SP 500 Close-to-Close

Dependent Variable: SP 500 Close-to-Close (Day of Week Model)
Method: ML - ARCH
Date: 08/15/05 Time: 19:56
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 56 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.098594	0.029973	3.289408	0.0010
SER03	-0.092531	0.042960	-2.153871	0.0313
SER04	-0.027805	0.043963	-0.632466	0.5271
SER05	-0.090318	0.042575	-2.121381	0.0339
SER06	-0.072070	0.040598	-1.775221	0.0759
AR(1)	0.046011	0.021369	2.153179	0.0313
Variance Equation				
C	-0.098931	0.009656	-10.24523	0.0000
|RES|/SQR[GARCH](1)	0.120826	0.012004	10.06517	0.0000
RES/SQR[GARCH](1)	-0.077773	0.008441	-9.213513	0.0000
EGARCH(1)	0.983031	0.002768	355.1989	0.0000

R-squared	0.000556	Mean dependent var	0.055814
Adjusted R-squared	-0.003019	S.D. dependent var	0.892111
S.E. of regression	0.893457	Akaike info criterion	2.387051
Sum squared resid	2008.435	Schwarz criterion	2.410148
Log likelihood	-3004.845	F-statistic	0.155561
Durbin-Watson stat	2.062665	Prob(F-statistic)	0.997813
Inverted AR Roots	.05		

SP 500 Futures Close-to-Close

Dependent Variable: SP 500 Futures Close-to-Close (Day of Week Model)
Method: ML - ARCH
Date: 08/15/05 Time: 22:51
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 66 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.084133	0.031657	2.657650	0.0079
SER05	-0.090483	0.044397	-2.038047	0.0415
SER06	-0.024683	0.046264	-0.533532	0.5937
SER07	-0.087126	0.043629	-1.996984	0.0458
SER08	-0.081049	0.043057	-1.882371	0.0598
AR(1)	0.012805	0.022026	0.581340	0.5610
	Variance Equation			
C	-0.106359	0.009999	-10.63710	0.0000
|RES|/SQR[GARCH](1)	0.132766	0.012638	10.50525	0.0000
RES/SQR[GARCH](1)	-0.096057	0.008412	-11.41866	0.0000
EGARCH(1)	0.980276	0.002783	352.1994	0.0000

R-squared	0.000247	Mean dependent var	0.043693
Adjusted R-squared	-0.003330	S.D. dependent var	0.954525
S.E. of regression	0.956113	Akaike info criterion	2.496165
Sum squared resid	2300.006	Schwarz criterion	2.519262
Log likelihood	-3142.656	F-statistic	0.068935
Durbin-Watson stat	2.086658	Prob(F-statistic)	0.999923
Inverted AR Roots	.01		

SP 500 Futures Close-to-Open

Dependent Variable: SP 500 Futures Close-to-Open (Day of Week Model)
Method: ML - ARCH
Date: 08/15/05 Time: 23:11
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 91 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.023119	0.012144	-1.903750	0.0569
SER05	0.028986	0.016495	1.757221	0.0789
SER06	0.025377	0.018745	1.353753	0.1758
SER07	0.031853	0.016566	1.922808	0.0545
SER08	0.008927	0.016031	0.556850	0.5776
AR(1)	-0.012404	0.022095	-0.561411	0.5745
		Variance Equation		
C	-0.176007	0.009466	-18.59313	0.0000
|RES|/SQR[GARCH](1)	0.204739	0.010803	18.95131	0.0000
RES/SQR[GARCH](1)	-0.061418	0.007417	-8.280898	0.0000
EGARCH(1)	0.983076	0.002122	463.3110	0.0000

R-squared	-0.001168	Mean dependent var	0.012873
Adjusted R-squared	-0.004750	S.D. dependent var	0.435636
S.E. of regression	0.436669	Akaike info criterion	0.788717
Sum squared resid	479.7503	Schwarz criterion	0.811814
Log likelihood	-986.1493	Durbin-Watson stat	2.138019
Inverted AR Roots	-.01		

SP 500 Futures Open-to-Close

Dependent Variable: SP 500 Futures Open-to-Close (Day of Week Model)
Method: ML - ARCH
Date: 08/15/05 Time: 23:26
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 53 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.089884	0.030515	2.945609	0.0032
SER05	-0.105697	0.040541	-2.607199	0.0091
SER06	-0.047873	0.043377	-1.103633	0.2698
SER07	-0.093669	0.042390	-2.209696	0.0271
SER08	-0.109152	0.042105	-2.592380	0.0095
AR(1)	0.004015	0.020906	0.192050	0.8477
	Variance Equation			
C	-0.084415	0.009103	-9.273575	0.0000
|RES|/SQR[GARCH](1)	0.103119	0.011161	9.239390	0.0000
RES/SQR[GARCH](1)	-0.071926	0.006335	-11.35299	0.0000
EGARCH(1)	0.985806	0.002212	445.6136	0.0000

R-squared	0.001035	Mean dependent var	0.030820
Adjusted R-squared	-0.002539	S.D. dependent var	0.861718
S.E. of regression	0.862811	Akaike info criterion	2.319223
Sum squared resid	1873.017	Schwarz criterion	2.342321
Log likelihood	-2919.179	F-statistic	0.289554
Durbin-Watson stat	2.103740	Prob(F-statistic)	0.977829

Inverted AR Roots	.00

Monday Model

DJIA Close-to-Close

DJIA: Monday Model Close-Close
Dependent Variable: SER01
Method: ML - ARCH
Date: 08/15/05 Time: 17:21
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 61 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.144626	0.032052	4.512276	0.0000
SER04	-0.123541	0.035024	-3.527336	0.0004
AR(1)	0.051842	0.021726	2.386137	0.0170
		Variance Equation		
C	-0.099229	0.009338	-10.62672	0.0000
|RES|/SQR[GARCH](1)	0.119532	0.011467	10.42399	0.0000
RES/SQR[GARCH](1)	-0.076612	0.007960	-9.624278	0.0000
EGARCH(1)	0.978637	0.003268	299.4894	0.0000

R-squared	0.003122	Mean dependent var	0.055780
Adjusted R-squared	0.000748	S.D. dependent var	0.890749
S.E. of regression	0.890416	Akaike info criterion	2.426662
Sum squared resid	1997.166	Schwarz criterion	2.442830
Log likelihood	-3057.874	F-statistic	1.314944
Durbin-Watson stat	2.043614	Prob(F-statistic)	0.246757
Inverted AR Roots	.05		

DJIA Close-to-Open

Dependent Variable: DJIA Close-to-Open (Monday Model)
Method: ML - ARCH
Date: 08/15/05 Time: 18:24
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 278 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.018656	0.016006	-1.165565	0.2438
SER04	0.040566	0.018526	2.189742	0.0285
AR(1)	-0.044505	0.019476	-2.285149	0.0223
	Variance Equation			
C	-0.071605	0.003402	-21.04727	0.0000
|RES|/SQR[GARCH](1)	0.084077	0.004315	19.48390	0.0000
RES/SQR[GARCH](1)	-0.026432	0.003801	-6.954298	0.0000
EGARCH(1)	0.990709	0.001097	903.2962	0.0000

R-squared	0.003106	Mean dependent var	0.024179
Adjusted R-squared	0.000731	S.D. dependent var	0.488366
S.E. of regression	0.488187	Akaike info criterion	1.222403
Sum squared resid	600.3456	Schwarz criterion	1.238571
Log likelihood	-1536.894	F-statistic	1.307935
Durbin-Watson stat	2.026041	Prob(F-statistic)	0.249937
Inverted AR Roots	-.04		

DJIA Open-to-Close

Dependent Variable: DJIA Open-to-Close (Monday Model)
Method: ML - ARCH
Date: 08/15/05   Time: 18:32
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 91 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.149044	0.030408	4.901427	0.0000
SER04	-0.152656	0.033748	-4.523414	0.0000
AR(1)	0.005856	0.020536	0.285152	0.7755
		Variance Equation		
C	-0.125208	0.010601	-11.81120	0.0000
|RES|/SQR[GARCH](1)	0.141117	0.012101	11.66200	0.0000
RES/SQR[GARCH](1)	-0.069524	0.007463	-9.315380	0.0000
EGARCH(1)	0.970194	0.004286	226.3648	0.0000

R-squared	0.005423	Mean dependent var	0.031601
Adjusted R-squared	0.003054	S.D. dependent var	0.793801
S.E. of regression	0.792588	Akaike info criterion	2.223475
Sum squared resid	1582.426	Schwarz criterion	2.239643
Log likelihood	-2801.248	F-statistic	2.289154
Durbin-Watson stat	2.099508	Prob(F-statistic)	0.033068

Inverted AR Roots	.01

SP 500 Close-to-Close

Dependent Variable: SP Close-to-Close (Monday)
Method: ML - ARCH
Date: 08/15/05 Time: 19:36
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 42 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.098617	0.029860	3.302585	0.0010
SER02	-0.072086	0.033127	-2.176056	0.0296
AR(1)	0.047557	0.021519	2.210005	0.0271
		Variance Equation		
C	-0.099727	0.009731	-10.24835	0.0000
|RES|/SQR[GARCH](1)	0.121818	0.012099	10.06857	0.0000
RES/SQR[GARCH](1)	-0.078132	0.008411	-9.289696	0.0000
EGARCH(1)	0.982747	0.002739	358.8381	0.0000

R-squared	-0.000264	Mean dependent var	0.055814
Adjusted R-squared	-0.002646	S.D. dependent var	0.892111
S.E. of regression	0.893291	Akaike info criterion	2.385896
Sum squared resid	2010.082	Schwarz criterion	2.402064
Log likelihood	-3006.387	Durbin-Watson stat	2.066718
Inverted AR Roots	.05		

SP 500 Futures Close-to-Close

SP 500 Futures Close-to-close (Monday Model)
Method: ML - ARCH
Date: 08/15/05 Time: 21:30
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 78 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.084398	0.031632	2.668067	0.0076
SER04	-0.070376	0.035327	-1.992121	0.0464
AR(1)	0.008990	0.022130	0.406243	0.6846
		Variance Equation		
C	-0.108239	0.010031	-10.79078	0.0000
|RES|/SQR[GARCH](1)	0.135122	0.012661	10.67263	0.0000
RES/SQR[GARCH](1)	-0.095792	0.008338	-11.48877	0.0000
EGARCH(1)	0.979904	0.002802	349.7217	0.0000

R-squared	0.000202	Mean dependent var	0.043693
Adjusted R-squared	-0.002179	S.D. dependent var	0.954525
S.E. of regression	0.955565	Akaike info criterion	2.495003
Sum squared resid	2300.108	Schwarz criterion	2.511171
Log likelihood	-3144.189	F-statistic	0.085026
Durbin-Watson stat	2.080136	Prob(F-statistic)	0.997708
Inverted AR Roots	.01		

SP 500 Futures Close-to-Open

Dependent Variable: SPF Close-to-Open (Monday Model)
Method: ML - ARCH
Date: 08/15/05 Time: 21:50
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 100 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.023523	0.011948	-1.968781	0.0490
SER04	0.025106	0.013198	1.902259	0.0571
AR(1)	-0.009362	0.021813	-0.429207	0.6678
		Variance Equation		
C	-0.177906	0.009187	-19.36532	0.0000
|RES|/SQR[GARCH](1)	0.206447	0.010757	19.19235	0.0000
RES/SQR[GARCH](1)	-0.059110	0.007423	-7.963143	0.0000
EGARCH(1)	0.982685	0.001981	496.0581	0.0000

R-squared	-0.000423	Mean dependent var	0.012873
Adjusted R-squared	-0.002806	S.D. dependent var	0.435636
S.E. of regression	0.436246	Akaike info criterion	0.787043
Sum squared resid	479.3930	Schwarz criterion	0.803211
Log likelihood	-987.0356	Durbin-Watson stat	2.142892
Inverted AR Roots	-.01		

SP 500 Futures Open-to-Close

Dependent Variable: SP 500 Futures Open-to-Close (Monday Model)
Method: ML - ARCH
Date: 08/15/05 Time: 22:07
Sample(adjusted): 2 2527
Included observations: 2526 after adjusting endpoints
Convergence achieved after 47 iterations

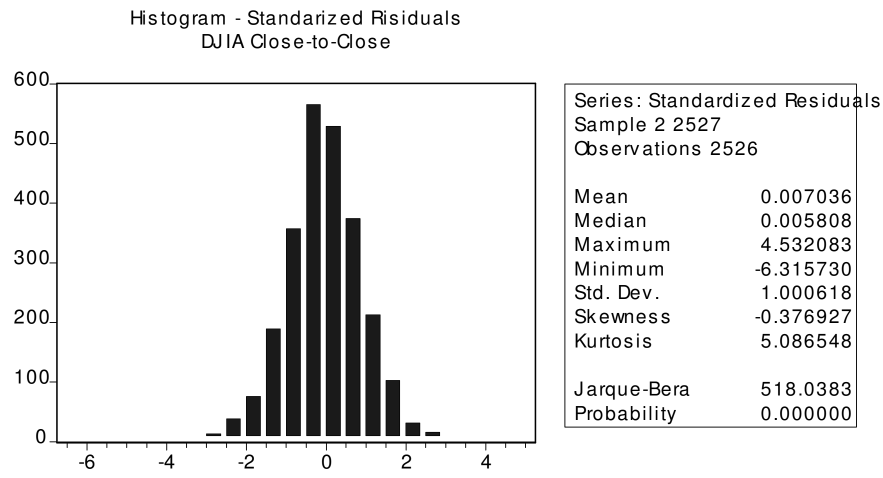
	Coefficient	Std. Error	z-Statistic	Prob.
C	0.089748	0.030513	2.941327	0.0033
SER04	-0.088384	0.033567	-2.633072	0.0085
AR(1)	0.003809	0.020809	0.183051	0.8548
		Variance Equation		
C	-0.087044	0.009273	-9.386546	0.0000
|RES|/SQR[GARCH](1)	0.106231	0.011365	9.347295	0.0000
RES/SQR[GARCH](1)	-0.072352	0.006401	-11.30382	0.0000
EGARCH(1)	0.985282	0.002247	438.5721	0.0000

R-squared	0.000861	Mean dependent var	0.030820
Adjusted R-squared	-0.001518	S.D. dependent var	0.861718
S.E. of regression	0.862372	Akaike info criterion	2.317894
Sum squared resid	1873.342	Schwarz criterion	2.334062
Log likelihood	-2920.500	F-statistic	0.361986
Durbin-Watson stat	2.103742	Prob(F-statistic)	0.903149
Inverted AR Roots	.00		

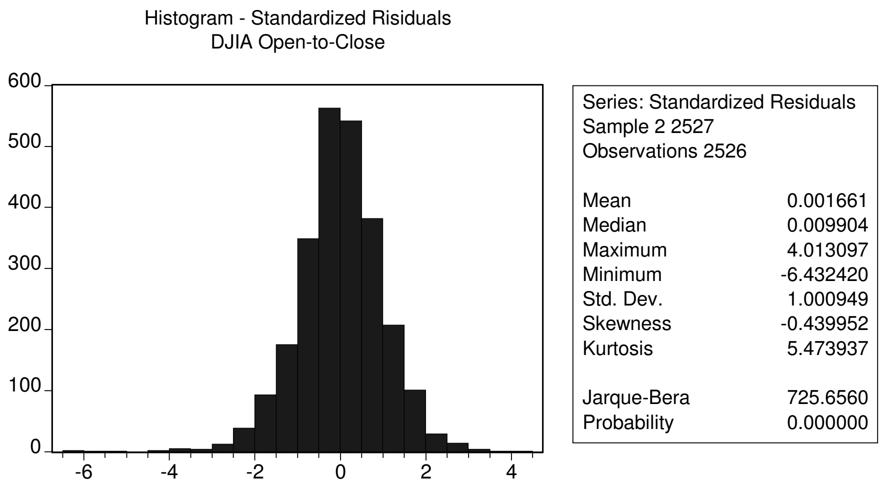
Normality Tests – Histograms

Day of the Week Model

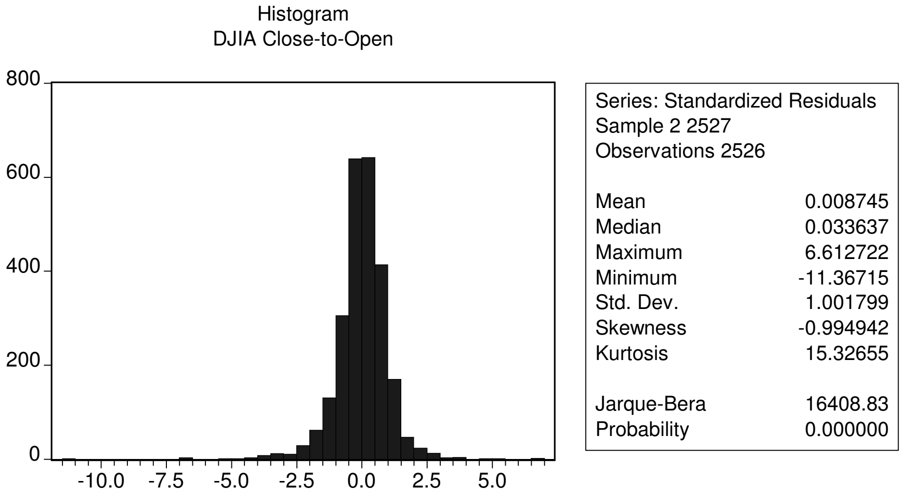
DJIA Close-to-Close



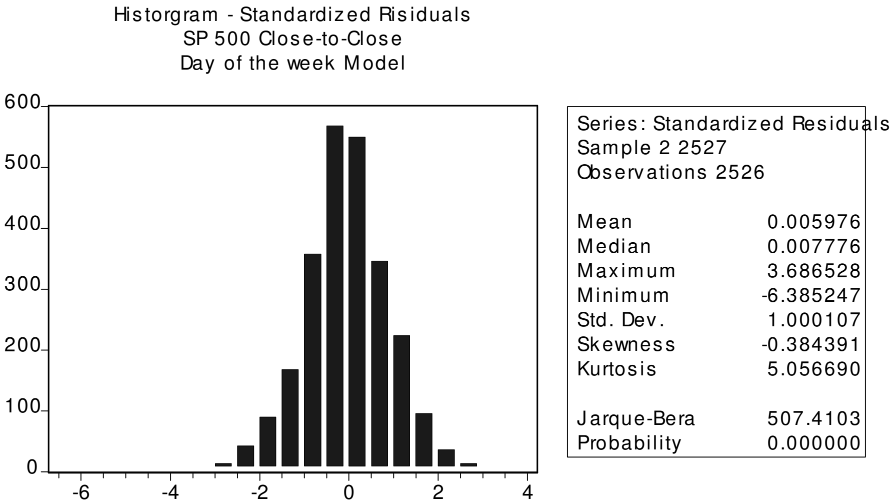
DJIA Open-to-Close



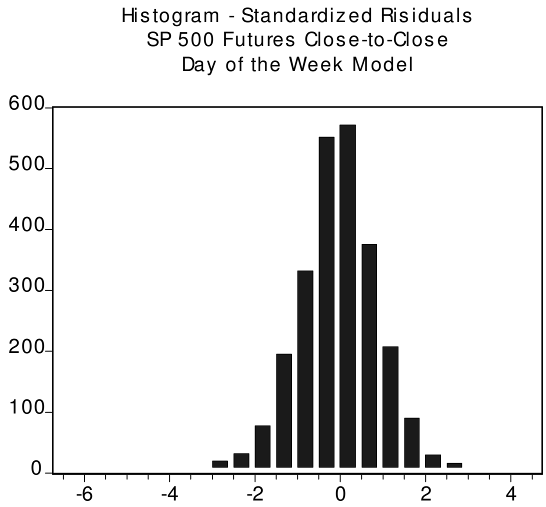
DJIA Close-to-Open



SP 500 Close-to-Close

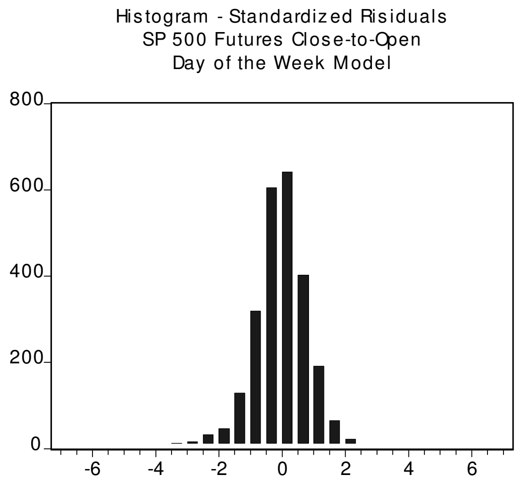


SP 500 Futures Close-to-Close



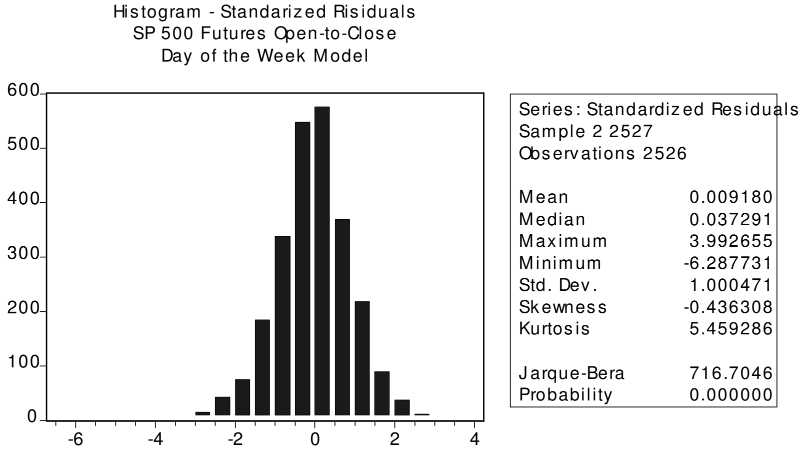
Series: Standardized Residuals	
Sample 2 2527	
Observations 2526	
Mean	0.006201
Median	0.028040
Maximum	4.072292
Minimum	-6.212422
Std. Dev.	1.000333
Skewness	-0.409597
Kurtosis	5.197675
Jarque-Bera	578.9648
Probability	0.000000

SP 500 Futures Close-to-Open



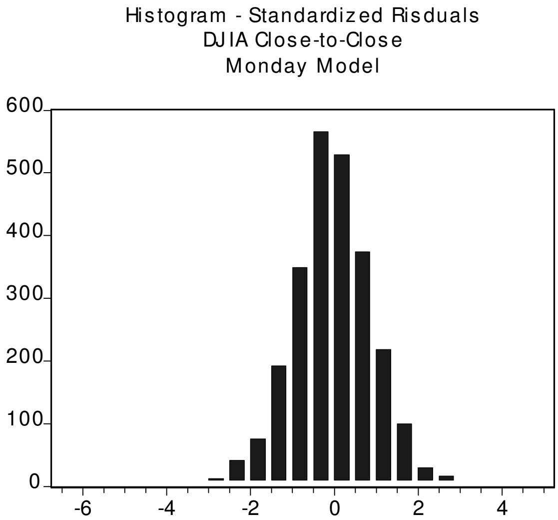
Series: Standardized Residuals	
Sample 2 2527	
Observations 2526	
Mean	0.026971
Median	0.073100
Maximum	6.569937
Minimum	-6.625393
Std. Dev.	1.001390
Skewness	-0.708835
Kurtosis	8.440664
Jarque-Bera	3327.017
Probability	0.000000

SP 500 Futures Open-to-Close



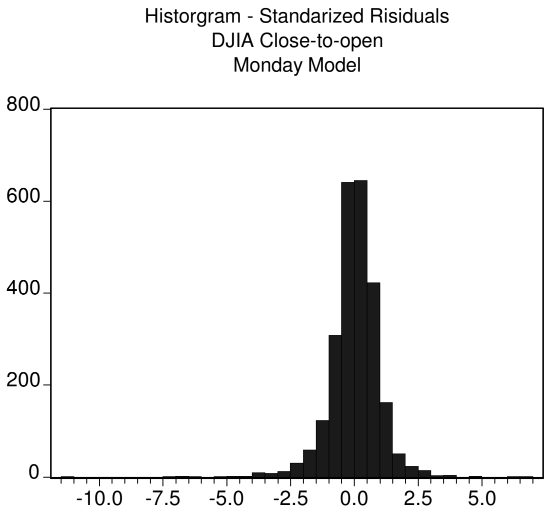
Monday Model

DJIA Close-to-Close



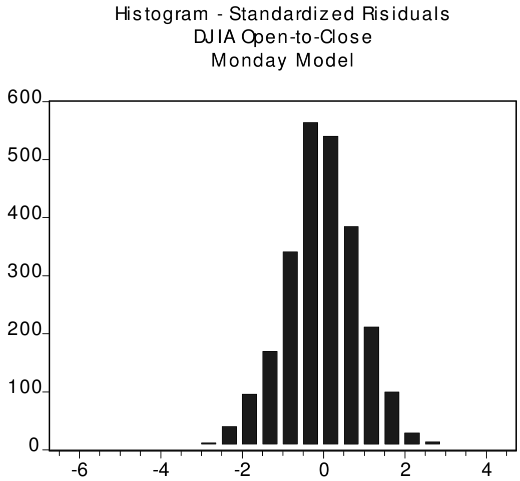
Series: Standardized Residuals	
Sample 2 2527	
Observations 2526	
Mean	0.005178
Median	0.008444
Maximum	4.503402
Minimum	-6.230585
Std. Dev.	1.000630
Skewness	-0.374961
Kurtosis	5.062002
Jarque-Bera	506.6981
Probability	0.000000

DJIA Close-to-Open



Series: Standardized Residuals	
Sample 2 2527	
Observations 2526	
Mean	0.013374
Median	0.042924
Maximum	6.651477
Minimum	-11.01466
Std. Dev.	1.001808
Skewness	-1.064941
Kurtosis	15.18552
Jarque-Bera	16105.70
Probability	0.000000

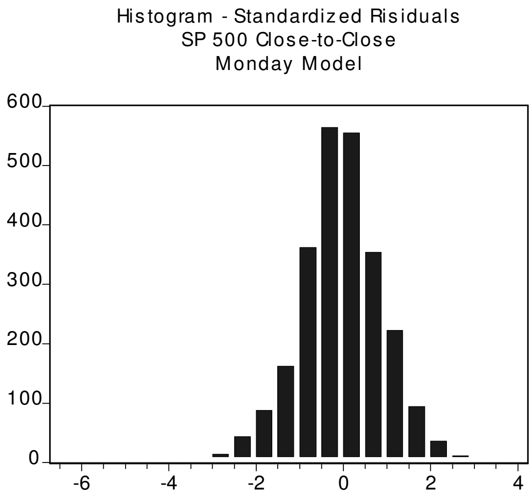
DJIA Open-to-Close



Series: Standardized Residuals
Sample 2 2527
Observations 2526

Mean	0.003623
Median	0.018318
Maximum	4.071793
Minimum	-6.386427
Std. Dev.	1.000860
Skewness	-0.422756
Kurtosis	5.440900
Jarque-Bera	702.3210
Probability	0.000000

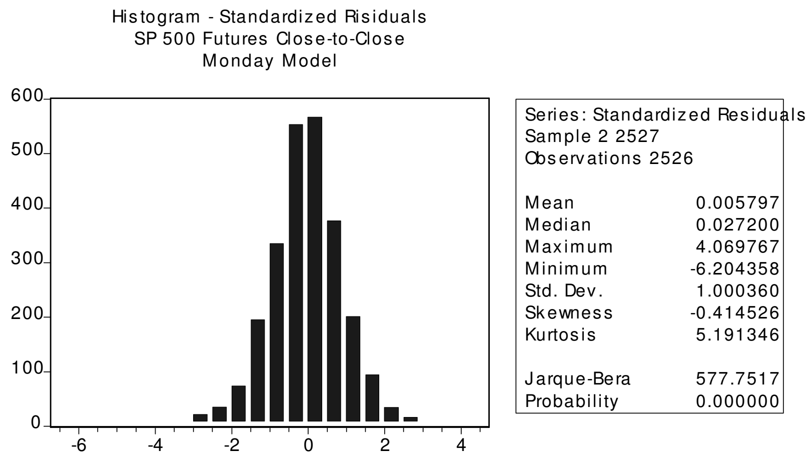
SP 500 Close-to-Close



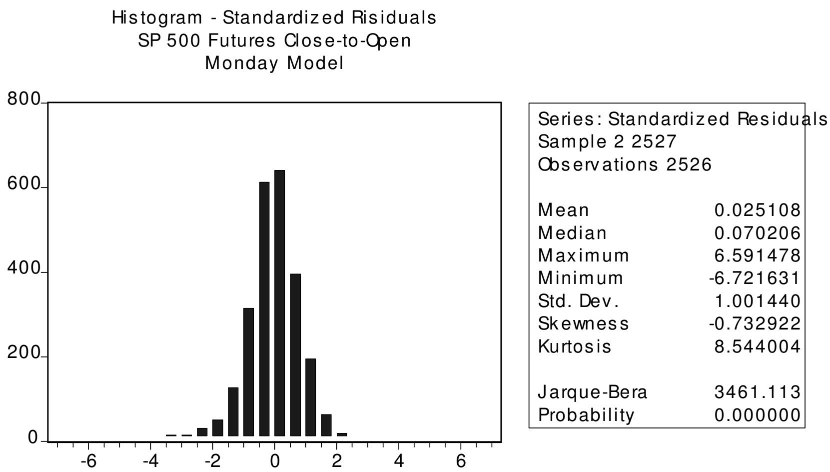
Series: Standardized Residuals
Sample 2 2527
Observations 2526

Mean	0.007345
Median	0.012132
Maximum	3.669581
Minimum	-6.408980
Std. Dev.	1.000105
Skewness	-0.390534
Kurtosis	5.054270
Jarque-Bera	508.3673
Probability	0.000000

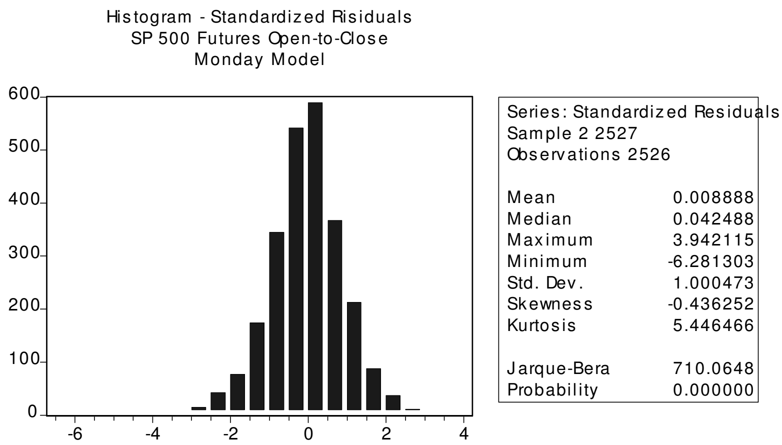
SP 500 Futures Close-to-Close



SP 500 Futures Close-to-Open



SP 500 Futures Open-to-Close



Standardized Residuals- Q-Statistics

Day of the Week Model

DJIA: Close-to-Close

DJIA Close-to-Close: Standardized Residuals
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Auto Correlation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.007	0.007	0.1184	
| |	| |	2	0.003	0.003	0.1486	0.700
| |	| |	3	-0.041	-0.041	4.4671	0.107
| |	| |	4	-0.028	-0.028	6.5111	0.089
| |	| |	5	-0.008	-0.008	6.6919	0.153
| |	| |	6	0.012	0.010	7.0455	0.217
| |	| |	7	-0.024	-0.026	8.4503	0.207
| |	| |	8	-0.007	-0.008	8.5708	0.285
| |	| |	9	0.010	0.010	8.8060	0.359
| |	| |	10	0.029	0.028	10.958	0.279
| |	| |	11	-0.019	-0.022	11.907	0.291
| |	| |	12	0.029	0.029	14.057	0.230
| |	| |	13	0.018	0.021	14.841	0.250
| |	| |	14	-0.010	-0.011	15.108	0.301
| |	| |	15	-0.010	-0.009	15.358	0.354
| |	| |	16	-0.036	-0.034	18.710	0.227

DJIA Open-to-Close

DJIA Open-to-Close
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.009	-0.009	0.1876	
| |	| |	2	0.030	0.030	2.5209	0.112
| |	| |	3	-0.007	-0.006	2.6387	0.267
| |	| |	4	-0.002	-0.003	2.6479	0.449
| |	| |	5	-0.014	-0.014	3.1676	0.530
| |	| |	6	0.040	0.040	7.2358	0.204
| |	| |	7	-0.027	-0.025	9.0192	0.173
| |	| |	8	0.000	-0.003	9.0193	0.251
| |	| |	9	0.022	0.024	10.194	0.252
| |	| |	10	0.018	0.019	11.052	0.272
| |	| |	11	0.002	0.002	11.063	0.353
| |	| |	12	0.014	0.011	11.554	0.398
| |	| |	13	-0.002	0.001	11.561	0.482
| |	| |	14	-0.020	-0.021	12.593	0.480
| |	| |	15	0.011	0.010	12.921	0.533
| |	| |	16	-0.027	-0.026	14.749	0.470

DJIA Close-to-Open

DJIA Close-to-Open
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.013	-0.013	0.4487	
| |	| |	2	-0.038	-0.038	4.0458	0.044
| |	| |	3	-0.006	-0.007	4.1424	0.126
| |	| |	4	0.026	0.024	5.8150	0.121
| |	| |	5	0.017	0.017	6.5332	0.163
| |	| |	6	0.009	0.012	6.7521	0.240
| |	| |	7	-0.025	-0.023	8.3604	0.213
| |	| |	8	-0.006	-0.007	8.4670	0.293
| |	| |	9	0.004	0.002	8.5145	0.385
| |	| |	10	-0.012	-0.013	8.8775	0.449
| |	| |	11	-0.011	-0.010	9.1845	0.515
| |	| |	12	0.017	0.017	9.8992	0.539
| |	| |	13	0.034	0.035	12.899	0.376
| |	| |	14	-0.007	-0.005	13.039	0.445
| |	| |	15	0.005	0.008	13.097	0.519
| |	| |	16	-0.039	-0.039	16.954	0.322

SP 500 Close-to-Close

SP 500 Close-to-Close (Day of the Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.006	0.006	0.0786	
| |	| |	2	0.006	0.006	0.1841	0.668
| |	| |	3	-0.049	-0.049	6.3358	0.042
| |	| |	4	-0.026	-0.026	8.0962	0.044
| |	| |	5	-0.032	-0.031	10.664	0.031
| |	| |	6	0.000	-0.002	10.664	0.058
| |	| |	7	-0.028	-0.030	12.641	0.049
| |	| |	8	-0.010	-0.014	12.916	0.074
| |	| |	9	0.009	0.008	13.118	0.108
| |	| |	10	0.032	0.028	15.689	0.074
| |	| |	11	-0.012	-0.016	16.084	0.097
| |	| |	12	0.034	0.032	18.941	0.062
| |	| |	13	0.036	0.039	22.195	0.035
| |	| |	14	-0.021	-0.022	23.294	0.038
| |	| |	15	-0.006	-0.003	23.397	0.054
| |	| |	16	-0.024	-0.019	24.860	0.052

SP 500 Futures Close-to-Close

SP 500 Futures Close-to-Close (Day of Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.001	0.001	0.0017	
| |	| |	2	-0.008	-0.008	0.1842	0.668
| |	| |	3	-0.034	-0.034	3.1209	0.210
| |	| |	4	-0.026	-0.026	4.8277	0.185
| |	| |	5	-0.035	-0.036	7.9998	0.092
| |	| |	6	-0.002	-0.004	8.0095	0.156
| |	| |	7	-0.025	-0.028	9.6381	0.141
| |	| |	8	-0.007	-0.010	9.7492	0.203
| |	| |	9	0.006	0.003	9.8357	0.277
| |	| |	10	0.026	0.023	11.546	0.240
| |	| |	11	-0.010	-0.012	11.813	0.298
| |	| |	12	0.037	0.036	15.296	0.169
| |	| |	13	0.026	0.028	17.059	0.147
| |	| |	14	-0.017	-0.016	17.773	0.166
| |	| |	15	-0.006	-0.003	17.881	0.212
| |	| |	16	-0.024	-0.021	19.387	0.197

SP 500 Futures Close-to-Open

SP 500 Futures Close-to-Open (Day of Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.023	-0.023	1.3918	
| |	| |	2	-0.018	-0.019	2.2422	0.134
| |	| |	3	-0.004	-0.005	2.2925	0.318
| |	| |	4	0.004	0.004	2.3363	0.506
| |	| |	5	-0.009	-0.009	2.5293	0.639
| |	| |	6	-0.015	-0.015	3.0871	0.687
| |	| |	7	-0.022	-0.023	4.2819	0.639
| |	| |	8	-0.028	-0.030	6.2572	0.510
| |	| |	9	-0.016	-0.018	6.8833	0.549
| |	| |	10	0.009	0.007	7.0908	0.628
| |	| |	11	0.000	-0.001	7.0910	0.717
| |	| |	12	0.006	0.005	7.1757	0.785
| |	| |	13	0.031	0.030	9.5443	0.656
| |	| |	14	-0.004	-0.004	9.5910	0.727
| |	| |	15	0.033	0.033	12.390	0.575
| |	| |	16	-0.007	-0.007	12.513	0.640

SP 500 Futures Open-to-Close

SP 500 Futures Open-to-Close (Day of Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.009	-0.009	0.2234	
| |	| |	2	0.011	0.011	0.5193	0.471
| |	| |	3	-0.018	-0.018	1.3448	0.510
| |	| |	4	-0.012	-0.012	1.7046	0.636
| |	| |	5	-0.033	-0.033	4.4162	0.353
| |	| |	6	0.027	0.027	6.3267	0.276
| |	| |	7	-0.026	-0.025	8.0549	0.234
| |	| |	8	-0.002	-0.005	8.0693	0.327
| |	| |	9	0.015	0.016	8.6304	0.374
| |	| |	10	0.033	0.032	11.328	0.254
| |	| |	11	0.000	0.001	11.328	0.333
| |	| |	12	0.017	0.015	12.098	0.356
| |	| |	13	0.006	0.009	12.185	0.431
| |	| |	14	-0.029	-0.028	14.378	0.348
| |	| |	15	0.007	0.008	14.489	0.414
| |	| |	16	-0.016	-0.016	15.178	0.439

Monday Model

DJIA Close-to-Close

DJIA Close-Close Monday Model
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.007	0.007	0.1311	
| |	| |	2	0.002	0.001	0.1370	0.711
| |	| |	3	-0.038	-0.038	3.7143	0.156
| |	| |	4	-0.029	-0.028	5.8340	0.120
| |	| |	5	-0.012	-0.011	6.1840	0.186
| |	| |	6	0.016	0.015	6.8198	0.234
| |	| |	7	-0.026	-0.028	8.5104	0.203
| |	| |	8	-0.011	-0.013	8.8413	0.264
| |	| |	9	0.012	0.013	9.1991	0.326
| |	| |	10	0.029	0.028	11.398	0.249
| |	| |	11	-0.017	-0.020	12.144	0.276
| |	| |	12	0.029	0.028	14.263	0.219
| |	| |	13	0.018	0.021	15.055	0.238
| |	| |	14	-0.011	-0.012	15.389	0.284
| |	| |	15	-0.006	-0.006	15.491	0.345
| |	| |	16	-0.035	-0.033	18.615	0.232

DJIA Close-to-Open

DJIA Close-to-Open (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.002	-0.002	0.0069	
| |	| |	2	-0.038	-0.038	3.6604	0.056
| |	| |	3	-0.006	-0.006	3.7480	0.154
| |	| |	4	0.029	0.027	5.8627	0.118
| |	| |	5	0.013	0.012	6.2742	0.180
| |	| |	6	0.014	0.016	6.7462	0.240
| |	| |	7	-0.023	-0.022	8.0636	0.233
| |	| |	8	-0.007	-0.006	8.1726	0.318
| |	| |	9	0.007	0.005	8.2889	0.406
| |	| |	10	-0.014	-0.015	8.7625	0.459
| |	| |	11	-0.009	-0.008	8.9858	0.533
| |	| |	12	0.022	0.022	10.212	0.511
| |	| |	13	0.033	0.033	12.962	0.372
| |	| |	14	-0.010	-0.008	13.203	0.432
| |	| |	15	0.016	0.019	13.865	0.460
| |	| |	16	-0.034	-0.035	16.832	0.329

DJIA Open-to-Close

DJIA Open-to-Close (Monday)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.012	-0.012	0.3348	
| |	| |	2	0.029	0.029	2.4223	0.120
| |	| |	3	-0.006	-0.005	2.5168	0.284
| |	| |	4	-0.003	-0.003	2.5330	0.469
| |	| |	5	-0.014	-0.014	3.0262	0.553
| |	| |	6	0.043	0.043	7.6490	0.177
| |	| |	7	-0.030	-0.028	9.8857	0.130
| |	| |	8	-0.004	-0.007	9.9247	0.193
| |	| |	9	0.023	0.025	11.263	0.187
| |	| |	10	0.016	0.017	11.904	0.219
| |	| |	11	0.002	0.002	11.915	0.291
| |	| |	12	0.012	0.009	12.310	0.341
| |	| |	13	0.000	0.003	12.310	0.421
| |	| |	14	-0.018	-0.018	13.117	0.439
| |	| |	15	0.014	0.012	13.635	0.477
| |	| |	16	-0.026	-0.025	15.399	0.423

SP 500 Close-to-Close

SP 500 Close-to-Close (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.004	0.004	0.0411	
| |	| |	2	0.005	0.005	0.1156	0.734
| |	| |	3	-0.049	-0.049	6.1059	0.047
| |	| |	4	-0.027	-0.026	7.9046	0.048
| |	| |	5	-0.031	-0.031	10.391	0.034
| |	| |	6	0.000	-0.001	10.391	0.065
| |	| |	7	-0.028	-0.031	12.439	0.053
| |	| |	8	-0.011	-0.015	12.755	0.078
| |	| |	9	0.010	0.008	12.992	0.112
| |	| |	10	0.032	0.028	15.596	0.076
| |	| |	11	-0.012	-0.015	15.949	0.101
| |	| |	12	0.032	0.030	18.558	0.069
| |	| |	13	0.036	0.039	21.820	0.040
| |	| |	14	-0.020	-0.020	22.823	0.044
| |	| |	15	-0.006	-0.003	22.913	0.062
| |	| |	16	-0.023	-0.018	24.275	0.061

SP 500 Futures Close-to-Close

SP 500 Futures Close-to-Close (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.004	0.004	0.0459	
| |	| |	2	-0.009	-0.010	0.2733	0.601
| |	| |	3	-0.034	-0.034	3.2319	0.199
| |	| |	4	-0.026	-0.026	4.9285	0.177
| |	| |	5	-0.035	-0.036	8.0366	0.090
| |	| |	6	-0.002	-0.003	8.0458	0.154
| |	| |	7	-0.026	-0.029	9.7767	0.134
| |	| |	8	-0.007	-0.010	9.9151	0.193
| |	| |	9	0.006	0.004	10.011	0.264
| |	| |	10	0.027	0.023	11.805	0.225
| |	| |	11	-0.010	-0.012	12.049	0.282
| |	| |	12	0.036	0.034	15.258	0.171
| |	| |	13	0.026	0.027	17.017	0.149
| |	| |	14	-0.016	-0.015	17.658	0.171
| |	| |	15	-0.006	-0.002	17.741	0.219
| |	| |	16	-0.024	-0.021	19.197	0.205

SP 500 Futures Close-to-Open

SP 500 Futures Close-to-Open (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.026	-0.026	1.6961	
| |	| |	2	-0.018	-0.019	2.5234	0.112
| |	| |	3	-0.004	-0.005	2.5700	0.277
| |	| |	4	0.004	0.003	2.6053	0.457
| |	| |	5	-0.009	-0.009	2.8134	0.590
| |	| |	6	-0.014	-0.015	3.3261	0.650
| |	| |	7	-0.021	-0.022	4.4839	0.611
| |	| |	8	-0.028	-0.030	6.4728	0.486
| |	| |	9	-0.015	-0.017	7.0378	0.533
| |	| |	10	0.008	0.006	7.2167	0.615
| |	| |	11	0.000	0.000	7.2170	0.705
| |	| |	12	0.005	0.005	7.2921	0.775
| |	| |	13	0.030	0.029	9.5997	0.651
| |	| |	14	-0.004	-0.004	9.6348	0.723
| |	| |	15	0.033	0.032	12.379	0.576
| |	| |	16	-0.007	-0.006	12.503	0.641

SP 500 Futures Open-to-Close

SP 500 Futures Open-to-Close (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.009	-0.009	0.2097	
| |	| |	2	0.010	0.010	0.4667	0.494
| |	| |	3	-0.018	-0.018	1.3165	0.518
| |	| |	4	-0.012	-0.012	1.6516	0.648
| |	| |	5	-0.032	-0.032	4.2027	0.379
| |	| |	6	0.028	0.027	6.1299	0.294
| |	| |	7	-0.027	-0.027	7.9966	0.238
| |	| |	8	-0.003	-0.005	8.0135	0.331
| |	| |	9	0.015	0.016	8.5931	0.378
| |	| |	10	0.034	0.033	11.451	0.246
| |	| |	11	0.000	0.001	11.451	0.323
| |	| |	12	0.016	0.013	12.078	0.358
| |	| |	13	0.006	0.009	12.163	0.433
| |	| |	14	-0.029	-0.028	14.240	0.357
| |	| |	15	0.008	0.009	14.405	0.420
| |	| |	16	-0.016	-0.016	15.073	0.446

Standardized Residuals Squared – Q-Statistics

Day of the Week Model

DJIA Close-to-Close

DJIA Close-to-Close
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.003	0.003	0.0229	
| |	| |	2	0.019	0.019	0.9038	0.342
| |	| |	3	-0.023	-0.023	2.2599	0.323
| |	| |	4	0.002	0.002	2.2672	0.519
| |	| |	5	-0.005	-0.004	2.3310	0.675
| |	| |	6	0.000	0.000	2.3311	0.802
| |	| |	7	0.012	0.012	2.6909	0.847
| |	| |	8	0.000	-0.001	2.6912	0.912
| |	| |	9	-0.005	-0.006	2.7592	0.949
| |	| |	10	0.005	0.006	2.8284	0.971
| |	| |	11	0.002	0.002	2.8420	0.985
| |	| |	12	-0.022	-0.022	4.0383	0.969
| |	| |	13	-0.018	-0.018	4.8641	0.962
| |	| |	14	0.010	0.011	5.1128	0.973
| |	| |	15	0.004	0.004	5.1533	0.984
| |	| |	16	-0.026	-0.027	6.8844	0.961

DJIA Open-to-Close

DJIA Open-to-Close
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|* |	|* |	1	0.067	0.067	11.477	
| |	| |	2	0.013	0.009	11.914	0.001
| |	| |	3	-0.018	-0.020	12.749	0.002
| |	| |	4	-0.006	-0.004	12.846	0.005
| |	| |	5	-0.012	-0.011	13.221	0.010
| |	| |	6	-0.020	-0.019	14.246	0.014
| |	| |	7	0.009	0.012	14.444	0.025
| |	| |	8	-0.006	-0.008	14.544	0.042
| |	| |	9	-0.020	-0.020	15.579	0.049
| |	| |	10	0.014	0.017	16.048	0.066
| |	| |	11	-0.018	-0.020	16.834	0.078
| |	| |	12	-0.011	-0.010	17.122	0.104
| |	| |	13	-0.007	-0.004	17.238	0.141
| |	| |	14	-0.008	-0.008	17.394	0.182
| |	| |	15	0.004	0.004	17.429	0.234
| |	| |	16	-0.006	-0.006	17.526	0.288

DJIA Close-to-Open

DJIA Close-to-Open (Squared)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.011	0.011	0.2853	
| |	| |	2	0.027	0.027	2.1587	0.142
| |	| |	3	0.012	0.012	2.5409	0.281
| |	| |	4	-0.003	-0.004	2.5672	0.463
| |	| |	5	0.007	0.007	2.6951	0.610
| |	| |	6	-0.013	-0.013	3.1010	0.684
| |	| |	7	-0.006	-0.006	3.1947	0.784
| |	| |	8	-0.010	-0.009	3.4286	0.843
| |	| |	9	-0.007	-0.006	3.5502	0.895
| |	| |	10	0.003	0.003	3.5685	0.937
| |	| |	11	-0.006	-0.005	3.6553	0.962
| |	| |	12	-0.016	-0.016	4.3158	0.960
| |	| |	13	0.003	0.003	4.3352	0.977
| |	| |	14	-0.002	-0.001	4.3446	0.987
| |	| |	15	0.006	0.006	4.4319	0.992
| |	| |	16	-0.014	-0.014	4.8984	0.993

SP 500 Close-to-Close

SP 500 Close-to-Close (Day of the Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.005	-0.005	0.0632	
| |	| |	2	0.020	0.020	1.1078	0.293
| |	| |	3	-0.015	-0.015	1.6938	0.429
| |	| |	4	0.003	0.003	1.7244	0.632
| |	| |	5	0.004	0.004	1.7577	0.780
| |	| |	6	0.001	0.001	1.7605	0.881
| |	| |	7	-0.015	-0.015	2.3270	0.887
| |	| |	8	-0.005	-0.005	2.3964	0.935
| |	| |	9	-0.004	-0.003	2.4377	0.965
| |	| |	10	0.011	0.011	2.7593	0.973
| |	| |	11	-0.002	-0.002	2.7715	0.986
| |	| |	12	-0.027	-0.028	4.6500	0.947
| |	| |	13	-0.007	-0.007	4.7919	0.965
| |	| |	14	0.012	0.013	5.1779	0.971
| |	| |	15	-0.003	-0.004	5.2022	0.983
| |	| |	16	-0.004	-0.005	5.2438	0.990

SP 500 Futures Close-to-Close

SP 500 Futures Close-to-Close (Day of Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.014	-0.014	0.4938	
| |	| |	2	0.025	0.025	2.0428	0.153
| |	| |	3	-0.015	-0.014	2.5870	0.274
| |	| |	4	-0.001	-0.002	2.5882	0.460
| |	| |	5	0.007	0.008	2.7130	0.607
| |	| |	6	-0.006	-0.006	2.7968	0.731
| |	| |	7	-0.003	-0.003	2.8152	0.832
| |	| |	8	-0.003	-0.002	2.8329	0.900
| |	| |	9	-0.011	-0.011	3.1635	0.924
| |	| |	10	0.013	0.012	3.5603	0.938
| |	| |	11	-0.008	-0.008	3.7397	0.958
| |	| |	12	-0.023	-0.024	5.0659	0.928
| |	| |	13	-0.008	-0.008	5.2325	0.950
| |	| |	14	0.015	0.016	5.7880	0.954
| |	| |	15	-0.013	-0.013	6.1922	0.961
| |	| |	16	-0.012	-0.014	6.5895	0.968

SP 500 Futures Close-to-Open

SP 500 Futures Close-to-Open (Day of Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.012	0.012	0.3740	
| |	| |	2	0.010	0.010	0.6417	0.423
| |	| |	3	0.018	0.018	1.4563	0.483
| |	| |	4	-0.015	-0.016	2.0242	0.567
| |	| |	5	-0.003	-0.003	2.0478	0.727
| |	| |	6	-0.025	-0.025	3.6500	0.601
| |	| |	7	-0.025	-0.024	5.2865	0.508
| |	| |	8	0.003	0.004	5.3165	0.621
| |	| |	9	-0.016	-0.014	5.9269	0.655
| |	| |	10	-0.005	-0.004	5.9850	0.741
| |	| |	11	-0.032	-0.032	8.5148	0.579
| |	| |	12	-0.014	-0.013	9.0104	0.621
| |	| |	13	0.021	0.021	10.148	0.603
| |	| |	14	0.010	0.010	10.383	0.662
| |	| |	15	0.005	0.003	10.438	0.730
| |	| |	16	-0.014	-0.017	10.941	0.757

SP 500 Futures Open-to-Close

SP 500 Futures Open-to-Close (Day of Week Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.044	0.044	4.8412	
| |	| |	2	0.021	0.020	6.0011	0.014
| |	| |	3	-0.016	-0.018	6.6697	0.036
| |	| |	4	-0.007	-0.006	6.8117	0.078
| |	| |	5	-0.011	-0.010	7.1332	0.129
| |	| |	6	-0.015	-0.015	7.7404	0.171
| |	| |	7	0.000	0.001	7.7404	0.258
| |	| |	8	0.007	0.007	7.8497	0.346
| |	| |	9	-0.018	-0.020	8.7011	0.368
| |	| |	10	0.030	0.031	10.993	0.276
| |	| |	11	-0.010	-0.012	11.237	0.339
| |	| |	12	-0.021	-0.023	12.403	0.334
| |	| |	13	-0.010	-0.007	12.679	0.393
| |	| |	14	-0.011	-0.010	12.989	0.449
| |	| |	15	-0.012	-0.012	13.377	0.497
| |	| |	16	0.002	0.004	13.388	0.572

Monday Model

DJIA Close-to-Close

DJIA Close-to-Close - Monday Model
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.002	0.002	0.0075	
| |	| |	2	0.020	0.020	1.0577	0.304
| |	| |	3	-0.022	-0.022	2.2463	0.325
| |	| |	4	0.004	0.003	2.2827	0.516
| |	| |	5	-0.006	-0.005	2.3608	0.670
| |	| |	6	0.000	-0.001	2.3609	0.797
| |	| |	7	0.014	0.015	2.8733	0.825
| |	| |	8	-0.001	-0.001	2.8759	0.896
| |	| |	9	-0.003	-0.003	2.8975	0.941
| |	| |	10	0.003	0.004	2.9191	0.967
| |	| |	11	0.003	0.003	2.9405	0.983
| |	| |	12	-0.020	-0.021	4.0038	0.970
| |	| |	13	-0.020	-0.020	5.0691	0.956
| |	| |	14	0.012	0.013	5.4185	0.965
| |	| |	15	0.001	0.001	5.4212	0.979
| |	| |	16	-0.015	-0.017	6.0259	0.979

DJIA Close-to-Open

DJIA Close-to-Open (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.013	0.013	0.4344	
| |	| |	2	0.026	0.026	2.2093	0.137
| |	| |	3	0.011	0.010	2.5122	0.285
| |	| |	4	0.003	0.002	2.5391	0.468
| |	| |	5	0.008	0.008	2.7119	0.607
| |	| |	6	-0.013	-0.014	3.1613	0.675
| |	| |	7	-0.006	-0.006	3.2414	0.778
| |	| |	8	-0.012	-0.011	3.6121	0.823
| |	| |	9	-0.008	-0.007	3.7768	0.877
| |	| |	10	0.002	0.003	3.7898	0.925
| |	| |	11	-0.009	-0.008	3.9798	0.948
| |	| |	12	-0.018	-0.018	4.7760	0.942
| |	| |	13	0.003	0.004	4.8020	0.964
| |	| |	14	-0.004	-0.003	4.8351	0.979
| |	| |	15	0.027	0.027	6.6740	0.947
| |	| |	16	-0.008	-0.008	6.8260	0.962

DJIA Close-to-Open

DJIA Open-to-Close (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.065	0.065	10.604	
| |	| |	2	0.019	0.015	11.493	0.001
| |	| |	3	-0.017	-0.020	12.255	0.002
| |	| |	4	-0.006	-0.004	12.340	0.006
| |	| |	5	-0.011	-0.010	12.673	0.013
| |	| |	6	-0.024	-0.022	14.081	0.015
| |	| |	7	0.012	0.015	14.435	0.025
| |	| |	8	-0.010	-0.011	14.688	0.040
| |	| |	9	-0.019	-0.019	15.627	0.048
| |	| |	10	0.016	0.019	16.257	0.062
| |	| |	11	-0.015	-0.017	16.804	0.079
| |	| |	12	-0.008	-0.007	16.955	0.109
| |	| |	13	-0.010	-0.008	17.222	0.141
| |	| |	14	-0.011	-0.011	17.507	0.177
| |	| |	15	0.004	0.005	17.549	0.228
| |	| |	16	-0.001	-0.001	17.554	0.287

SP 500 Close-to-Close

SP 500 Close-to-Close (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.006	-0.006	0.0983	
| |	| |	2	0.022	0.022	1.3178	0.251
| |	| |	3	-0.016	-0.016	1.9746	0.373
| |	| |	4	0.003	0.003	2.0049	0.571
| |	| |	5	0.004	0.004	2.0382	0.729
| |	| |	6	0.001	0.000	2.0396	0.844
| |	| |	7	-0.014	-0.014	2.5219	0.866
| |	| |	8	-0.003	-0.003	2.5401	0.924
| |	| |	9	-0.005	-0.005	2.6103	0.956
| |	| |	10	0.010	0.010	2.8631	0.969
| |	| |	11	-0.002	-0.002	2.8786	0.984
| |	| |	12	-0.027	-0.027	4.7277	0.944
| |	| |	13	-0.009	-0.009	4.9358	0.960
| |	| |	14	0.012	0.013	5.3019	0.968
| |	| |	15	-0.003	-0.004	5.3264	0.981
| |	| |	16	-0.003	-0.004	5.3475	0.989

SP 500 Futures Close-to-Open

SP 500 Futures Close-to-Open (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.013	0.013	0.4140	
| |	| |	2	0.010	0.010	0.6560	0.418
| |	| |	3	0.018	0.018	1.4563	0.483
| |	| |	4	-0.015	-0.016	2.0448	0.563
| |	| |	5	-0.004	-0.004	2.0774	0.722
| |	| |	6	-0.025	-0.025	3.7200	0.590
| |	| |	7	-0.026	-0.025	5.4032	0.493
| |	| |	8	0.004	0.005	5.4390	0.607
| |	| |	9	-0.016	-0.015	6.0638	0.640
| |	| |	10	-0.006	-0.005	6.1422	0.726
| |	| |	11	-0.032	-0.032	8.6729	0.563
| |	| |	12	-0.014	-0.013	9.1780	0.605
| |	| |	13	0.020	0.020	10.219	0.597
| |	| |	14	0.010	0.010	10.450	0.657
| |	| |	15	0.004	0.002	10.482	0.726
| |	| |	16	-0.013	-0.016	10.940	0.757

SP 500 Futures Close-to-Close

SP 500 Futures Close-to-Close (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	-0.016	-0.016	0.6142	
| |	| |	2	0.026	0.026	2.3001	0.129
| |	| |	3	-0.016	-0.015	2.9206	0.232
| |	| |	4	-0.001	-0.002	2.9231	0.404
| |	| |	5	0.007	0.008	3.0595	0.548
| |	| |	6	-0.006	-0.006	3.1469	0.677
| |	| |	7	-0.001	-0.002	3.1504	0.790
| |	| |	8	-0.001	0.000	3.1525	0.871
| |	| |	9	-0.012	-0.012	3.5354	0.896
| |	| |	10	0.012	0.012	3.9083	0.917
| |	| |	11	-0.009	-0.008	4.1041	0.943
| |	| |	12	-0.023	-0.024	5.4139	0.909
| |	| |	13	-0.009	-0.009	5.6146	0.934
| |	| |	14	0.014	0.015	6.0995	0.942
| |	| |	15	-0.012	-0.013	6.4884	0.953
| |	| |	16	-0.011	-0.012	6.7982	0.963

SP 500 Futures Open-to-Close

SP 500 Futures Open-to-Close (Monday Model)
Sample: 2 2527
Included observations: 2526
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.042	0.042	4.4847	
| |	| |	2	0.022	0.020	5.6775	0.017
| |	| |	3	-0.016	-0.017	6.3018	0.043
| |	| |	4	-0.008	-0.007	6.4624	0.091
| |	| |	5	-0.011	-0.010	6.7687	0.149
| |	| |	6	-0.016	-0.015	7.4168	0.191
| |	| |	7	0.000	0.002	7.4172	0.284
| |	| |	8	0.007	0.007	7.5422	0.375
| |	| |	9	-0.019	-0.021	8.4894	0.387
| |	| |	10	0.030	0.031	10.735	0.294
| |	| |	11	-0.010	-0.012	10.991	0.358
| |	| |	12	-0.022	-0.023	12.237	0.346
| |	| |	13	-0.011	-0.008	12.569	0.401
| |	| |	14	-0.012	-0.010	12.930	0.453
| |	| |	15	-0.012	-0.012	13.324	0.501
| |	| |	16	0.004	0.006	13.366	0.574

Asymmetry Using Cross Correlations

Day of the Week Model

DJIA Close-to-Close

Date: 07/31/05 Time: 15:40
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

GARCH10_RESID01^2,GARCH10_RESID01(-i)	GARCH10_RESID01^2,GARCH10_RESID01(+i)	i	lag	lead
**| |	**| |	0	-0.1797	-0.1797
*| |	| |	1	-0.0541	0.0426
*| |	| |	2	-0.0514	-0.0116
| |	| |	3	-0.0300	-0.0113
|* |	| |	4	0.0500	0.0203
| |	| |	5	0.0018	0.0129
| |	| |	6	-0.0003	-0.0225
| |	| |	7	-0.0100	-0.0053
| |	| |	8	-0.0039	0.0126
| |	| |	9	0.0053	-0.0148
| |	| |	10	0.0125	0.0059
| |	| |	11	0.0129	-0.0026
| |	| |	12	0.0124	-0.0072
| |	| |	13	0.0189	-0.0117
| |	| |	14	0.0281	0.0200
| |	| |	15	0.0115	0.0210

DJIA Open-to-Close

DJIA Open-to-Close
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

DJIA_OC_RESID^2,DJIA_OC_RESID(-i)	DJIA_OC_RESID^2,DJIA_OC_RESID(+i)	i	lag	lead
**| |	**| |	0	-0.2065	-0.2065
*| |	| |	1	-0.0880	0.0385
| |	| |	2	-0.0396	0.0038
| |	| |	3	-0.0043	-0.0296
|* |	| |	4	0.0599	-0.0001
| |	| |	5	0.0242	0.0193
| |	| |	6	0.0219	-0.0142
| |	| |	7	-0.0093	0.0034
| |	| |	8	-0.0151	0.0321
| |	| |	9	0.0218	-0.0040
| |	| |	10	-0.0105	0.0162
| |	| |	11	0.0002	-0.0017
| |	| |	12	0.0288	-0.0212
| |	| |	13	0.0174	0.0076
| |	| |	14	0.0440	0.0179

DJIA Close-to-Open

DJIA Close-to-Open
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

RESID_CO^2,RESID_CO(-i)	RESID_CO^2,RESID_CO(+i)	i	lag	lead
***| |	***| |	0	-0.2586	-0.2586
| |	| |	1	-0.0158	0.0474
*| |	| |	2	-0.0439	0.0207
| |	| |	3	-0.0032	0.0041
| |	| |	4	-0.0168	0.0075
| |	| |	5	0.0021	0.0016
| |	| |	6	0.0009	0.0215
| |	| |	7	-0.0142	0.0023
| |	| |	8	-0.0088	-0.0016
| |	| |	9	0.0064	-0.0073
| |	| |	10	0.0023	0.0189
| |	| |	11	0.0287	0.0120
| |	| |	12	-0.0137	0.0145
| |	| |	13	0.0072	-0.0240
| |	| |	14	0.0246	0.0080

SP 500 Close-to-Close

SP 500 Close-to-Close (Day of Week Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

SPCCDOW^2,SPCCDOW(-i)	SPCCDOW^2,SPCCDOW(+i)	i	lag	lead
**| |	**| |	0	-0.1851	-0.1851
*| |	|* |	1	-0.0504	0.0505
*| |	| |	2	-0.0687	-0.0097
| |	| |	3	-0.0138	-0.0191
| |	| |	4	0.0366	0.0312
| |	| |	5	-0.0010	0.0334
| |	| |	6	-0.0016	-0.0231
| |	| |	7	-0.0007	-0.0016
| |	| |	8	-0.0009	0.0163
| |	| |	9	0.0070	-0.0128
| |	| |	10	0.0051	-0.0030
| |	| |	11	0.0083	0.0112
| |	| |	12	0.0064	-0.0096
| |	| |	13	0.0249	-0.0116
| |	| |	14	0.0279	0.0213

SP 500 Futures Close-to-Close

SP 500 Futures Close-to-Close (Day of Week Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

SPFCC^2,SPFCC(-i)	SPFCC^2,SPFCC(+i)	i	lag	lead
**| |	**| |	0	-0.1962	-0.1962
*| |	|* |	1	-0.0447	0.0534
*| |	| |	2	-0.0594	-0.0115
| |	| |	3	-0.0149	-0.0266
| |	| |	4	0.0314	0.0371
| |	| |	5	0.0127	0.0291
| |	| |	6	0.0024	-0.0216
| |	| |	7	-0.0061	-0.0051
| |	| |	8	-0.0029	0.0201
| |	| |	9	0.0191	-0.0175
| |	| |	10	-0.0049	-0.0016
| |	| |	11	0.0065	0.0150
| |	| |	12	0.0013	-0.0101
| |	| |	13	0.0325	-0.0033
| |	| |	14	0.0233	0.0176

SP 500 Futures Close-to-Open

SP 500 Futures Close-to-Open (Day of Week Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

RESID01^2,RESID01(-i)	RESID01^2,RESID01(+i)	i	lag	lead
**| |	**| |	0	-0.2413	-0.2413
| |	| |	1	-0.0281	0.0130
| |	| |	2	-0.0275	0.0081
| |	| |	3	-0.0086	0.0117
| |	| |	4	-0.0100	-0.0086
| |	| |	5	0.0258	-0.0054
| |	| |	6	0.0063	0.0180
| |	| |	7	0.0217	0.0051
| |	| |	8	-0.0156	0.0190
| |	| |	9	0.0230	0.0076
| |	| |	10	0.0169	0.0197
| |	| |	11	0.0050	0.0054
| |	| |	12	-0.0290	-0.0023
| |	| |	13	0.0082	-0.0129
| |	| |	14	0.0088	0.0139

SP 500 Futures Open-to-Close

SP 500 Futures Open-to-Close (Day of Week Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

RESID02^2,RESID02(-i)	RESID02^2,RESID02(+i)	i	lag	lead
**| |	**| |	0	-0.1983	-0.1983
*| |	| |	1	-0.0761	0.0439
*| |	| |	2	-0.0510	-0.0020
| |	| |	3	-0.0086	-0.0289
| |	| |	4	0.0353	0.0211
| |	|* |	5	0.0176	0.0509
| |	| |	6	0.0223	-0.0103
| |	| |	7	-0.0105	-0.0049
| |	| |	8	-0.0151	0.0188
| |	| |	9	0.0109	-0.0223
| |	| |	10	-0.0140	0.0083
| |	| |	11	-0.0025	0.0049
| |	| |	12	0.0124	-0.0151
| |	| |	13	0.0327	-0.0027
| |	| |	14	0.0199	0.0211

Monday Model

DJIA Close-to-Close

DJIA Close-to-Close Monday Model
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

MONCC^2,MONCC(-i)	MONCC^2,MONCC(+i)	i	lag	lead
**| |	**| |	0	-0.1811	-0.1811
*| |	| |	1	-0.0523	0.0434
*| |	| |	2	-0.0510	-0.0112
| |	| |	3	-0.0329	-0.0104
|* |	| |	4	0.0500	0.0183
| |	| |	5	0.0028	0.0158
| |	| |	6	-0.0030	-0.0249
| |	| |	7	-0.0088	-0.0048
| |	| |	8	0.0018	0.0193
| |	| |	9	0.0033	-0.0189
| |	| |	10	0.0138	0.0040
| |	| |	11	0.0121	-0.0034
| |	| |	12	0.0106	-0.0073
| |	| |	13	0.0180	-0.0096
| |	| |	14	0.0281	0.0197

DJIA Close-to-Open

DJIA Close-to-Open (Monday Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

MONCO^2,MONCO(-i)	MONCO^2,MONCO(+i)	i	lag	lead
***| |	***| |	0	-0.2762	-0.2762
| |	| |	1	-0.0072	0.0420
*| |	| |	2	-0.0470	0.0235
| |	| |	3	-0.0079	0.0029
| |	| |	4	-0.0170	-0.0024
| |	| |	5	0.0068	0.0072
| |	| |	6	-0.0037	0.0196
| |	| |	7	-0.0221	0.0064
| |	| |	8	-0.0037	-0.0043
| |	| |	9	0.0012	-0.0049
| |	| |	10	-0.0011	0.0208
| |	| |	11	0.0313	0.0079
| |	| |	12	-0.0133	0.0111
| |	| |	13	0.0042	-0.0206
| |	| |	14	0.0219	0.0151

DJIA Open-to-Close

DJIA Open-to-Close (Monday)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

MONOC^2,MONOC(-i)	MONOC^2,MONOC(+i)	i	lag	lead
**| |	**| |	0	-0.1973	-0.1973
*| |	| |	1	-0.0862	0.0365
| |	| |	2	-0.0380	0.0010
| |	| |	3	-0.0048	-0.0277
|* |	| |	4	0.0613	-0.0018
| |	| |	5	0.0265	0.0189
| |	| |	6	0.0142	-0.0143
| |	| |	7	-0.0069	0.0021
| |	| |	8	-0.0066	0.0395
| |	| |	9	0.0236	-0.0107
| |	| |	10	-0.0038	0.0158
| |	| |	11	-0.0037	-0.0010
| |	| |	12	0.0255	-0.0200
| |	| |	13	0.0135	0.0069
| |	| |	14	0.0367	0.0226

SP 500 Close-to-Close

SP 500 Close-to-Close (Monday Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

SPCCMON^2,SPCCMON(-i)	SPCCMON^2,SPCCMON(+i)	i	lag	lead
**| |	**| |	0	-0.1869	-0.1869
*| |	|* |	1	-0.0493	0.0515
*| |	| |	2	-0.0688	-0.0094
| |	| |	3	-0.0125	-0.0178
| |	| |	4	0.0356	0.0301
| |	| |	5	-0.0010	0.0322
| |	| |	6	-0.0018	-0.0225
| |	| |	7	-0.0005	-0.0019
| |	| |	8	0.0010	0.0184
| |	| |	9	0.0070	-0.0123
| |	| |	10	0.0037	-0.0045
| |	| |	11	0.0085	0.0108
| |	| |	12	0.0070	-0.0093
| |	| |	13	0.0255	-0.0114
| |	| |	14	0.0260	0.0219

SP 500 Futures Close-to-Close

SP 500 Futures Close-to-Close (Monday Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

SPFCC^2,SPFCC(-i)	SPFCC^2,SPFCC(+i)	i	lag	lead
**| |	**| |	0	-0.1970	-0.1970
*| |	|* |	1	-0.0450	0.0534
*| |	| |	2	-0.0586	-0.0115
| |	| |	3	-0.0144	-0.0259
| |	| |	4	0.0308	0.0367
| |	| |	5	0.0119	0.0281
| |	| |	6	0.0017	-0.0204
| |	| |	7	-0.0050	-0.0059
| |	| |	8	-0.0023	0.0212
| |	| |	9	0.0188	-0.0179
| |	| |	10	-0.0057	-0.0022
| |	| |	11	0.0062	0.0155
| |	| |	12	0.0027	-0.0097
| |	| |	13	0.0334	-0.0036
| |	| |	14	0.0223	0.0176

SP 500 Futures Close-to-Open

SP 500 Futures Close-to-Open (Monday Model)
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

SPFCO^2,SPFCO(-i)	SPFCO^2,SPFCO(+i)	i	lag	lead
***| |	***| |	0	-0.2498	-0.2498
| |	| |	1	-0.0287	0.0129
| |	| |	2	-0.0259	0.0096
| |	| |	3	-0.0081	0.0110
| |	| |	4	-0.0094	-0.0070
| |	| |	5	0.0233	-0.0068
| |	| |	6	0.0071	0.0177
| |	| |	7	0.0224	0.0058
| |	| |	8	-0.0147	0.0200
| |	| |	9	0.0217	0.0080
| |	| |	10	0.0167	0.0186
| |	| |	11	0.0059	0.0050
| |	| |	12	-0.0285	-0.0016
| |	| |	13	0.0079	-0.0126
| |	| |	14	0.0081	0.0137

SP 500 Futures Open-to-Close

Date: 08/15/05 Time: 22:18
Sample: 1 2527
Included observations: 2526
Correlations are asymptotically consistent approximations

SPFOC^2,SPFOC(-i)	SPFOC^2,SPFOC(+i)	i	lag	lead
**| |	**| |	0	-0.1988	-0.1988
*| |	| |	1	-0.0755	0.0443
*| |	| |	2	-0.0500	-0.0019
| |	| |	3	-0.0081	-0.0294
| |	| |	4	0.0352	0.0209
| |	|* |	5	0.0178	0.0496
| |	| |	6	0.0214	-0.0081
| |	| |	7	-0.0093	-0.0062
| |	| |	8	-0.0128	0.0192
| |	| |	9	0.0111	-0.0218
| |	| |	10	-0.0148	0.0070
| |	| |	11	-0.0026	0.0054
| |	| |	12	0.0140	-0.0140
| |	| |	13	0.0322	-0.0024
| |	| |	14	0.0185	0.0210

ARCH LM TEST

Day of the Week Model

DJIA Close-to-Close

ARCH Test: DJIA Close-to-Close

F-statistic	0.400960	Probability	0.975168
Obs*R-squared	5.634495	Probability	0.974880

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 07/31/05 Time: 16:07
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.014616	0.084740	11.97324	0.0000
STD_RESID^2(-1)	0.005466	0.020011	0.273152	0.7848
STD_RESID^2(-2)	0.020505	0.019963	1.027186	0.3044
STD_RESID^2(-3)	-0.024781	0.019962	-1.241434	0.2146
STD_RESID^2(-4)	0.002952	0.019967	0.147868	0.8825
STD_RESID^2(-5)	-0.003018	0.019966	-0.151165	0.8799
STD_RESID^2(-6)	-0.005083	0.019982	-0.254372	0.7992
STD_RESID^2(-7)	0.013390	0.019983	0.670058	0.5029
STD_RESID^2(-8)	-0.000307	0.019931	-0.015394	0.9877
STD_RESID^2(-9)	-0.006605	0.019932	-0.331361	0.7404
STD_RESID^2(-10)	0.006149	0.019933	0.308479	0.7577
STD_RESID^2(-11)	0.003053	0.019934	0.153167	0.8783
STD_RESID^2(-12)	-0.021862	0.019928	-1.097032	0.2727
STD_RESID^2(-13)	-0.017717	0.019930	-0.888967	0.3741
STD_RESID^2(-14)	0.010822	0.019933	0.542909	0.5872

R-squared	0.002243	Mean dependent var	0.997498
Adjusted R-squared	-0.003351	S.D. dependent var	2.016414
S.E. of regression	2.019790	Akaike info criterion	4.249817
Sum squared resid	10186.64	Schwarz criterion	4.284623
Log likelihood	-5322.771	F-statistic	0.400960
Durbin-Watson stat	2.000099	Prob(F-statistic)	0.975168

DJIA Open-to-Close

ARCH Test: DJIA Open-to-Close

F-statistic	1.174299	Probability	0.280726
Obs*R-squared	18.77540	Probability	0.280482

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/14/05 Time: 16:22
Sample(adjusted): 18 2527
Included observations: 2510 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.019641	0.088569	11.51241	0.0000
STD_RESID^2(-1)	0.069217	0.020022	3.456980	0.0006
STD_RESID^2(-2)	0.007105	0.020063	0.354105	0.7233
STD_RESID^2(-3)	-0.023123	0.020060	-1.152675	0.2492
STD_RESID^2(-4)	-0.004518	0.019979	-0.226120	0.8211
STD_RESID^2(-5)	-0.009792	0.019977	-0.490171	0.6241
STD_RESID^2(-6)	-0.023108	0.019974	-1.156899	0.2474
STD_RESID^2(-7)	0.012865	0.019976	0.644033	0.5196
STD_RESID^2(-8)	-0.006587	0.019963	-0.329962	0.7415
STD_RESID^2(-9)	-0.022352	0.019972	-1.119158	0.2632
STD_RESID^2(-10)	0.017616	0.019973	0.882011	0.3779
STD_RESID^2(-11)	-0.018920	0.019972	-0.947349	0.3436
STD_RESID^2(-12)	-0.008971	0.019974	-0.449116	0.6534
STD_RESID^2(-13)	-0.004131	0.019974	-0.206804	0.8362
STD_RESID^2(-14)	-0.008215	0.019970	-0.411350	0.6809

R-squared	0.007480	Mean dependent var	0.994617
Adjusted R-squared	0.001110	S.D. dependent var	2.112784
S.E. of regression	2.111611	Akaike info criterion	4.339529
Sum squared resid	11116.04	Schwarz criterion	4.379002
Log likelihood	-5429.109	F-statistic	1.174299
Durbin-Watson stat	1.999305	Prob(F-statistic)	0.280726

DJIA Close-to-Open

ARCH Test: DJIA Close-to-Open

F-statistic	0.298430	Probability	0.994250
Obs*R-squared	4.196103	Probability	0.994166

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/14/05 Time: 16:53
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.997402	0.105469	9.456798	0.0000
STD_RESID^2(-1)	0.010301	0.020012	0.514730	0.6068
STD_RESID^2(-2)	0.026549	0.020013	1.326583	0.1848
STD_RESID^2(-3)	0.012031	0.020017	0.601052	0.5479
STD_RESID^2(-4)	-0.004103	0.020018	-0.204943	0.8376
STD_RESID^2(-5)	0.006916	0.020018	0.345463	0.7298
STD_RESID^2(-6)	-0.012140	0.020019	-0.606422	0.5443
STD_RESID^2(-7)	-0.005894	0.020020	-0.294436	0.7684
STD_RESID^2(-8)	-0.009063	0.019998	-0.453185	0.6505
STD_RESID^2(-9)	-0.005766	0.019997	-0.288357	0.7731
STD_RESID^2(-10)	0.003802	0.019997	0.190135	0.8492
STD_RESID^2(-11)	-0.005133	0.019997	-0.256672	0.7975
STD_RESID^2(-12)	-0.016189	0.019996	-0.809614	0.4182
STD_RESID^2(-13)	0.003281	0.019992	0.164143	0.8696
STD_RESID^2(-14)	-0.001138	0.019991	-0.056904	0.9546

R-squared	0.001670	Mean dependent var	1.000723
Adjusted R-squared	-0.003927	S.D. dependent var	3.799282
S.E. of regression	3.806735	Akaike info criterion	5.517374
Sum squared resid	36184.60	Schwarz criterion	5.552180
Log likelihood	-6914.822	F-statistic	0.298430
Durbin-Watson stat	1.989688	Prob(F-statistic)	0.994250

SP 500 Close-to-Close

ARCH Test: SP 500 Close-to-Close (Day of Week Model)

F-statistic	0.375148	Probability	0.981869
Obs*R-squared	5.272527	Probability	0.981647

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 20:12
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.024471	0.085357	12.00222	0.0000
STD_RESID^2(-1)	-0.003417	0.020010	-0.170762	0.8644
STD_RESID^2(-2)	0.021609	0.019991	1.080917	0.2798
STD_RESID^2(-3)	-0.015234	0.019988	-0.762142	0.4460
STD_RESID^2(-4)	0.003283	0.019990	0.164218	0.8696
STD_RESID^2(-5)	0.004651	0.019990	0.232653	0.8161
STD_RESID^2(-6)	-0.001586	0.019997	-0.079311	0.9368
STD_RESID^2(-7)	-0.013762	0.019997	-0.688196	0.4914
STD_RESID^2(-8)	-0.005246	0.019974	-0.262642	0.7928
STD_RESID^2(-9)	-0.004192	0.019974	-0.209850	0.8338
STD_RESID^2(-10)	0.011781	0.019975	0.589809	0.5554
STD_RESID^2(-11)	-0.001825	0.019977	-0.091334	0.9272
STD_RESID^2(-12)	-0.027899	0.019974	-1.396766	0.1626
STD_RESID^2(-13)	-0.007170	0.019978	-0.358904	0.7197
STD_RESID^2(-14)	0.013108	0.019979	0.656120	0.5118

R-squared	0.002099	Mean dependent var	0.998550
Adjusted R-squared	-0.003496	S.D. dependent var	2.012737
S.E. of regression	2.016252	Akaike info criterion	4.246311
Sum squared resid	10150.99	Schwarz criterion	4.281117
Log likelihood	-5318.367	F-statistic	0.375148
Durbin-Watson stat	1.999896	Prob(F-statistic)	0.981869

SP 500 Futures Close-to-Close

ARCH Test: SP 500 Futures Close-to-Close (Day of Week Model)

F-statistic	0.429155	Probability	0.966103
Obs*R-squared	6.029761	Probability	0.965736

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 23:07
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.027002	0.085881	11.95844	0.0000
STD_RESID^2(-1)	-0.011420	0.020010	-0.570737	0.5682
STD_RESID^2(-2)	0.026116	0.019983	1.306908	0.1914
STD_RESID^2(-3)	-0.014676	0.019984	-0.734375	0.4628
STD_RESID^2(-4)	-0.000657	0.019986	-0.032894	0.9738
STD_RESID^2(-5)	0.007986	0.019985	0.399584	0.6895
STD_RESID^2(-6)	-0.008813	0.019991	-0.440832	0.6594
STD_RESID^2(-7)	-0.001704	0.019992	-0.085240	0.9321
STD_RESID^2(-8)	-0.002198	0.019958	-0.110119	0.9123
STD_RESID^2(-9)	-0.012122	0.019957	-0.607379	0.5437
STD_RESID^2(-10)	0.012970	0.019957	0.649874	0.5158
STD_RESID^2(-11)	-0.007857	0.019959	-0.393651	0.6939
STD_RESID^2(-12)	-0.024112	0.019958	-1.208145	0.2271
STD_RESID^2(-13)	-0.007777	0.019957	-0.389705	0.6968
STD_RESID^2(-14)	0.015705	0.019957	0.786972	0.4314

R-squared	0.002400	Mean dependent var	0.998441
Adjusted R-squared	-0.003193	S.D. dependent var	2.045947
S.E. of regression	2.049210	Akaike info criterion	4.278739
Sum squared resid	10485.56	Schwarz criterion	4.313545
Log likelihood	-5359.097	F-statistic	0.429155
Durbin-Watson stat	1.999586	Prob(F-statistic)	0.966103

SP 500 Futures Close-to-Open

ARCH Test: SP 500 Futures Close-to-Open (Day of Week Model)

F-statistic	0.719220	Probability	0.756830
Obs*R-squared	10.08888	Probability	0.755657

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 23:23
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.053517	0.093327	11.28844	0.0000
STD_RESID^2(-1)	0.012269	0.020010	0.613125	0.5398
STD_RESID^2(-2)	0.005210	0.020007	0.260403	0.7946
STD_RESID^2(-3)	0.019540	0.020006	0.976701	0.3288
STD_RESID^2(-4)	-0.014205	0.020000	-0.710249	0.4776
STD_RESID^2(-5)	-0.003376	0.020001	-0.168809	0.8660
STD_RESID^2(-6)	-0.023216	0.019978	-1.162028	0.2453
STD_RESID^2(-7)	-0.024995	0.019983	-1.250812	0.2111
STD_RESID^2(-8)	0.005404	0.019863	0.272086	0.7856
STD_RESID^2(-9)	-0.013490	0.019858	-0.679332	0.4970
STD_RESID^2(-10)	-0.003915	0.019860	-0.197117	0.8438
STD_RESID^2(-11)	-0.032499	0.019857	-1.636665	0.1018
STD_RESID^2(-12)	-0.013518	0.019864	-0.680514	0.4962
STD_RESID^2(-13)	0.020508	0.019865	1.032367	0.3020
STD_RESID^2(-14)	0.009877	0.019868	0.497108	0.6192

R-squared	0.004016	Mean dependent var	0.996836
Adjusted R-squared	-0.001568	S.D. dependent var	2.708681
S.E. of regression	2.710804	Akaike info criterion	4.838321
Sum squared resid	18349.10	Schwarz criterion	4.873127
Log likelihood	-6061.931	F-statistic	0.719220
Durbin-Watson stat	1.998064	Prob(F-statistic)	0.756830

SP 500 Futures Open-to-Close

ARCH Test: SP 500 Futures Open-to-Close (Day of Week Model)

F-statistic	0.971589	Probability	0.480077
Obs*R-squared	13.60982	Probability	0.479165

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 23:40
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.012022	0.084273	12.00878	0.0000
STD_RESID^2(-1)	0.045222	0.020011	2.259793	0.0239
STD_RESID^2(-2)	0.020035	0.019991	1.002219	0.3163
STD_RESID^2(-3)	-0.018290	0.019989	-0.915000	0.3603
STD_RESID^2(-4)	-0.005671	0.019992	-0.283669	0.7767
STD_RESID^2(-5)	-0.008935	0.019983	-0.447129	0.6548
STD_RESID^2(-6)	-0.016686	0.019977	-0.835266	0.4036
STD_RESID^2(-7)	0.002275	0.019980	0.113860	0.9094
STD_RESID^2(-8)	0.007177	0.019980	0.359209	0.7195
STD_RESID^2(-9)	-0.022141	0.019978	-1.108263	0.2679
STD_RESID^2(-10)	0.032448	0.019982	1.623902	0.1045
STD_RESID^2(-11)	-0.011297	0.019991	-0.565128	0.5720
STD_RESID^2(-12)	-0.021629	0.019988	-1.082089	0.2793
STD_RESID^2(-13)	-0.006741	0.019989	-0.337213	0.7360
STD_RESID^2(-14)	-0.009538	0.019971	-0.477589	0.6330

R-squared	0.005418	Mean dependent var	0.998018
Adjusted R-squared	-0.000158	S.D. dependent var	2.110025
S.E. of regression	2.110192	Akaike info criterion	4.337389
Sum squared resid	11118.92	Schwarz criterion	4.372195
Log likelihood	-5432.760	F-statistic	0.971589
Durbin-Watson stat	1.999741	Prob(F-statistic)	0.480077

Monday Model

DJIA Close-to-Close

F-statistic	0.423266	Probability	0.968154
Obs*R-squared	5.947210	Probability	0.967805

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 17:50
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.008530	0.084451	11.94226	0.0000
STD_RESID^2(-1)	0.004317	0.020010	0.215740	0.8292
STD_RESID^2(-2)	0.022203	0.019959	1.112406	0.2661
STD_RESID^2(-3)	-0.023199	0.019960	-1.162271	0.2452
STD_RESID^2(-4)	0.005019	0.019964	0.251385	0.8015
STD_RESID^2(-5)	-0.003635	0.019964	-0.182056	0.8556
STD_RESID^2(-6)	-0.005294	0.019979	-0.264983	0.7910
STD_RESID^2(-7)	0.015698	0.019980	0.785670	0.4321
STD_RESID^2(-8)	-0.000879	0.019929	-0.044113	0.9648
STD_RESID^2(-9)	-0.004388	0.019930	-0.220172	0.8258
STD_RESID^2(-10)	0.003876	0.019930	0.194497	0.8458
STD_RESID^2(-11)	0.003590	0.019930	0.180113	0.8571
STD_RESID^2(-12)	-0.020467	0.019925	-1.027188	0.3044
STD_RESID^2(-13)	-0.020357	0.019926	-1.021623	0.3071
STD_RESID^2(-14)	0.012610	0.019931	0.632700	0.5270

R-squared	0.002368	Mean dependent var	0.997544
Adjusted R-squared	-0.003226	S.D. dependent var	2.010962
S.E. of regression	2.014203	Akaike info criterion	4.244278
Sum squared resid	10130.36	Schwarz criterion	4.279084
Log likelihood	-5315.813	F-statistic	0.423266
Durbin-Watson stat	2.000051	Prob(F-statistic)	0.968154

DJIA Close-to-Open

ARCH Test: DJIA Close-to-Open (Monday Model)

F-statistic	0.327891	Probability	0.990666
Obs*R-squared	4.609576	Probability	0.990539

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 18:29
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.998894	0.104998	9.513434	0.0000
STD_RESID^2(-1)	0.012589	0.020012	0.629048	0.5294
STD_RESID^2(-2)	0.025554	0.020013	1.276861	0.2018
STD_RESID^2(-3)	0.010411	0.020017	0.520121	0.6030
STD_RESID^2(-4)	0.002446	0.020017	0.122193	0.9028
STD_RESID^2(-5)	0.008067	0.020017	0.403013	0.6870
STD_RESID^2(-6)	-0.013140	0.020017	-0.656425	0.5116
STD_RESID^2(-7)	-0.005389	0.020018	-0.269218	0.7878
STD_RESID^2(-8)	-0.011378	0.019997	-0.568993	0.5694
STD_RESID^2(-9)	-0.006910	0.019996	-0.345586	0.7297
STD_RESID^2(-10)	0.003741	0.019996	0.187074	0.8516
STD_RESID^2(-11)	-0.007708	0.019996	-0.385455	0.6999
STD_RESID^2(-12)	-0.017507	0.019996	-0.875523	0.3814
STD_RESID^2(-13)	0.004155	0.019992	0.207811	0.8354
STD_RESID^2(-14)	-0.002844	0.019991	-0.142244	0.8869

R-squared	0.001835	Mean dependent var	1.000813
Adjusted R-squared	-0.003761	S.D. dependent var	3.777724
S.E. of regression	3.784822	Akaike info criterion	5.505828
Sum squared resid	35769.22	Schwarz criterion	5.540634
Log likelihood	-6900.320	F-statistic	0.327891
Durbin-Watson stat	1.988960	Prob(F-statistic)	0.990666

DJIA Open-to-Close

ARCH Test: DJIA Open-to-Close (Monday Model)

F-statistic	1.333794	Probability	0.178828
Obs*R-squared	18.64585	Probability	0.178927

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 18:48
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.010102	0.083468	12.10160	0.0000
STD_RESID^2(-1)	0.066703	0.020009	3.333672	0.0009
STD_RESID^2(-2)	0.015395	0.019968	0.770990	0.4408
STD_RESID^2(-3)	-0.021209	0.019968	-1.062186	0.2883
STD_RESID^2(-4)	-0.004462	0.019970	-0.223458	0.8232
STD_RESID^2(-5)	-0.008574	0.019965	-0.429443	0.6676
STD_RESID^2(-6)	-0.025660	0.019953	-1.286035	0.1986
STD_RESID^2(-7)	0.017401	0.019959	0.871872	0.3834
STD_RESID^2(-8)	-0.010134	0.019956	-0.507824	0.6116
STD_RESID^2(-9)	-0.021353	0.019961	-1.069772	0.2848
STD_RESID^2(-10)	0.019203	0.019964	0.961884	0.3362
STD_RESID^2(-11)	-0.016105	0.019967	-0.806563	0.4200
STD_RESID^2(-12)	-0.006185	0.019965	-0.309809	0.7567
STD_RESID^2(-13)	-0.007265	0.019963	-0.363936	0.7159
STD_RESID^2(-14)	-0.010708	0.019923	-0.537456	0.5910

R-squared	0.007423	Mean dependent var	0.996770
Adjusted R-squared	0.001858	S.D. dependent var	2.104516
S.E. of regression	2.102561	Akaike info criterion	4.330143
Sum squared resid	11038.64	Schwarz criterion	4.364949
Log likelihood	-5423.659	F-statistic	1.333794
Durbin-Watson stat	1.998205	Prob(F-statistic)	0.178828

SP 500 Close-to-Close

ARCH Test: SP 500 Close-to-Close (Monday Model)

F-statistic	0.384831	Probability	0.979525
Obs*R-squared	5.408332	Probability	0.979280

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 19:53
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.026101	0.085340	12.02372	0.0000
STD_RESID^2(-1)	-0.004542	0.020010	-0.226999	0.8204
STD_RESID^2(-2)	0.023145	0.019991	1.157763	0.2471
STD_RESID^2(-3)	-0.016122	0.019988	-0.806562	0.4200
STD_RESID^2(-4)	0.003249	0.019991	0.162538	0.8709
STD_RESID^2(-5)	0.004857	0.019990	0.242944	0.8081
STD_RESID^2(-6)	-0.002089	0.019997	-0.104485	0.9168
STD_RESID^2(-7)	-0.012603	0.019997	-0.630258	0.5286
STD_RESID^2(-8)	-0.002645	0.019974	-0.132408	0.8947
STD_RESID^2(-9)	-0.005457	0.019974	-0.273223	0.7847
STD_RESID^2(-10)	0.010412	0.019975	0.521232	0.6023
STD_RESID^2(-11)	-0.001930	0.019976	-0.096622	0.9230
STD_RESID^2(-12)	-0.027790	0.019973	-1.391338	0.1642
STD_RESID^2(-13)	-0.008827	0.019976	-0.441873	0.6586
STD_RESID^2(-14)	0.012874	0.019977	0.644431	0.5194

R-squared	0.002153	Mean dependent var	0.998605
Adjusted R-squared	-0.003442	S.D. dependent var	2.011531
S.E. of regression	2.014989	Akaike info criterion	4.245058
Sum squared resid	10138.27	Schwarz criterion	4.279864
Log likelihood	-5316.793	F-statistic	0.384831
Durbin-Watson stat	1.999900	Prob(F-statistic)	0.979525

SP 500 Futures Close-to-Close

ARCH Test: SP 500 Futures Close-to-Close (Monday Model)

F-statistic	0.451130	Probability	0.957682
Obs*R-squared	6.337735	Probability	0.957248

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 21:46
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.028762	0.085901	11.97618	0.0000
STD_RESID^2(-1)	-0.012923	0.020010	-0.645848	0.5184
STD_RESID^2(-2)	0.027096	0.019984	1.355904	0.1753
STD_RESID^2(-3)	-0.015598	0.019985	-0.780506	0.4352
STD_RESID^2(-4)	-0.000962	0.019987	-0.048142	0.9616
STD_RESID^2(-5)	0.008387	0.019986	0.419664	0.6748
STD_RESID^2(-6)	-0.009012	0.019991	-0.450794	0.6522
STD_RESID^2(-7)	-0.000217	0.019992	-0.010835	0.9914
STD_RESID^2(-8)	-0.000425	0.019958	-0.021283	0.9830
STD_RESID^2(-9)	-0.013049	0.019957	-0.653835	0.5133
STD_RESID^2(-10)	0.012472	0.019957	0.624960	0.5321
STD_RESID^2(-11)	-0.008091	0.019959	-0.405413	0.6852
STD_RESID^2(-12)	-0.024102	0.019957	-1.207685	0.2273
STD_RESID^2(-13)	-0.008594	0.019956	-0.430641	0.6668
STD_RESID^2(-14)	0.014763	0.019956	0.739779	0.4595

R-squared	0.002523	Mean dependent var	0.998500
Adjusted R-squared	-0.003070	S.D. dependent var	2.044564
S.E. of regression	2.047699	Akaike info criterion	4.277264
Sum squared resid	10470.10	Schwarz criterion	4.312070
Log likelihood	-5357.244	F-statistic	0.451130
Durbin-Watson stat	1.999614	Prob(F-statistic)	0.957682

SP 500 Futures Close-to-Open

ARCH Test: SP 500 Futures Close-to-Open (Monday Model)

F-statistic	0.725048	Probability	0.750809
Obs*R-squared	10.17030	Probability	0.749630

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 22:05
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.057026	0.093635	11.28882	0.0000
STD_RESID^2(-1)	0.012788	0.020010	0.639086	0.5228
STD_RESID^2(-2)	0.004879	0.020008	0.243873	0.8073
STD_RESID^2(-3)	0.019360	0.020007	0.967660	0.3333
STD_RESID^2(-4)	-0.014518	0.020000	-0.725904	0.4680
STD_RESID^2(-5)	-0.003915	0.020001	-0.195760	0.8448
STD_RESID^2(-6)	-0.023571	0.019981	-1.179676	0.2382
STD_RESID^2(-7)	-0.025384	0.019986	-1.270126	0.2042
STD_RESID^2(-8)	0.005762	0.019867	0.290027	0.7718
STD_RESID^2(-9)	-0.013724	0.019861	-0.690990	0.4896
STD_RESID^2(-10)	-0.004656	0.019863	-0.234389	0.8147
STD_RESID^2(-11)	-0.032519	0.019860	-1.637426	0.1017
STD_RESID^2(-12)	-0.013634	0.019867	-0.686269	0.4926
STD_RESID^2(-13)	0.019564	0.019868	0.984657	0.3249
STD_RESID^2(-14)	0.009736	0.019871	0.489970	0.6242

R-squared	0.004049	Mean dependent var	0.996914
Adjusted R-squared	-0.001535	S.D. dependent var	2.728769
S.E. of regression	2.730863	Akaike info criterion	4.853066
Sum squared resid	18621.66	Schwarz criterion	4.887872
Log likelihood	-6080.451	F-statistic	0.725048
Durbin-Watson stat	1.998129	Prob(F-statistic)	0.750809

SPF 500 Futures Open-to-Close

ARCH Test: SP 500 Futures Open-to-Close (Monday Model)

F-statistic	0.966177	Probability	0.485867
Obs*R-squared	13.53442	Probability	0.484941

Test Equation:
Dependent Variable: STD_RESID^2
Method: Least Squares
Date: 08/15/05 Time: 22:21
Sample(adjusted): 16 2527
Included observations: 2512 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.016614	0.084342	12.05354	0.0000
STD_RESID^2(-1)	0.043562	0.020011	2.176859	0.0296
STD_RESID^2(-2)	0.020427	0.019990	1.021857	0.3069
STD_RESID^2(-3)	-0.017696	0.019988	-0.885362	0.3760
STD_RESID^2(-4)	-0.006204	0.019990	-0.310372	0.7563
STD_RESID^2(-5)	-0.008717	0.019981	-0.436262	0.6627
STD_RESID^2(-6)	-0.017239	0.019975	-0.863010	0.3882
STD_RESID^2(-7)	0.002708	0.019979	0.135530	0.8922
STD_RESID^2(-8)	0.007618	0.019978	0.381302	0.7030
STD_RESID^2(-9)	-0.023136	0.019975	-1.158238	0.2469
STD_RESID^2(-10)	0.032120	0.019980	1.607620	0.1080
STD_RESID^2(-11)	-0.011345	0.019989	-0.567577	0.5704
STD_RESID^2(-12)	-0.022338	0.019986	-1.117659	0.2638
STD_RESID^2(-13)	-0.007788	0.019987	-0.389636	0.6968
STD_RESID^2(-14)	-0.010274	0.019971	-0.514436	0.6070

R-squared	0.005388	Mean dependent var	0.998075
Adjusted R-squared	-0.000189	S.D. dependent var	2.107142
S.E. of regression	2.107341	Akaike info criterion	4.334684
Sum squared resid	11088.89	Schwarz criterion	4.369490
Log likelihood	-5429.363	F-statistic	0.966177
Durbin-Watson stat	1.999742	Prob(F-statistic)	0.485867

Appendix 6: Volume Data

Descriptive Statistics

NYSE Volume - Descriptive Statistic
1990-1999

Monday - NYSE Volume	
Mean	361,052,787.01
Standard Error	9,775,170.92
Median	294,123,793.00
Mode	#N/A
Standard Deviation	214,608,974.35
Sample Variance	46,057,011,870,286,000.00
Kurtosis	0.43
Skewness	1.04
Range	1,159,471,703.00
Minimum	56,852,810.00
Maximum	1,216,324,513.00
Sum	174,027,443,338.00
Count	482.00

Tuesday - NYSE Volume	
Mean	390,490,753.93
Standard Error	9,703,548.03
Median	325,935,220.00
Mode	#N/A
Standard Deviation	221,062,073.27
Sample Variance	48,868,440,238,299,900.00
Kurtosis	0.09
Skewness	0.94
Range	1,111,496,097.00
Minimum	89,850,510.00
Maximum	1,201,346,607.00
Sum	202,664,701,292.00
Count	519.00

Wednesday - NYSE Volume	
Mean	396,936,814.61
Standard Error	9,847,053.15
Median	336,495,370.00
Mode	#N/A
Standard Deviation	223,682,049.22
Sample Variance	50,033,659,142,943,400.00
Kurtosis	- 0.11
Skewness	0.90
Range	1,036,247,680.00
Minimum	78,120,540.00
Maximum	1,114,368,220.00
Sum	204,819,396,340.00
Count	516.00

Thursday - NYSE Volume	
Mean	395,632,086.41
Standard Error	9,990,916.01
Median	320,244,593.00
Mode	#N/A
Standard Deviation	225,183,810.56
Sample Variance	50,707,748,538,094,500.00
Kurtosis	0.35
Skewness	1.03
Range	1,055,032,598.00
Minimum	95,139,560.00
Maximum	1,150,172,158.00
Sum	200,981,099,895.00
Count	508.00

Friday - NYSE Volume	
Mean	383,661,587.40
Standard Error	9,800,804.37
Median	311,065,530.00
Mode	#N/A
Standard Deviation	219,809,122.71
Sample Variance	48,316,050,426,865,500.00
Kurtosis	0.77
Skewness	1.09
Range	1,286,359,275.00
Minimum	63,351,720.00
Maximum	1,349,710,995.00
Sum	192,981,778,463.00
Count	503.00

All Days - NYSE Volume	
Mean	385,868,045.62
Standard Error	4,398,994.18
Median	313,576,115.00
Mode	163,564,350.00
Standard Deviation	221,177,997.78
Sample Variance	48,919,706,700,162,700.00
Kurtosis	0.28
Skewness	0.99
Range	1,292,858,185.00
Minimum	56,852,810.00
Maximum	1,349,710,995.00
Sum	975,474,419,328.00
Count	2,528.00

Appendix 6: Odd-lot Data

Descriptive Statistics

Odd-Lot Data

NYSE ODD-LOT DATA: Descriptive Statistics
1990-1999
Monday

purchase		*sales*	
Mean	1540.090788	Mean	1721.660539
Standard Error	59.88117346	Standard Error	55.26157574
Median	1038.25	Median	1365.9
Mode	478.7	Mode	763.3
Standard Deviation	1314.661127	Standard Deviation	1213.240176
Sample Variance	1728333.878	Sample Variance	1471951.725
Kurtosis	6.381202479	Kurtosis	3.535332552
Skewness	2.210075276	Skewness	1.694004656
Range	9809.5	Range	8092.7
Minimum	175.2	Minimum	290.1
Maximum	9984.7	Maximum	8382.8
Sum	742323.76	Sum	829840.38
Count	482	Count	482

Tuesday

Purchases		*Sales*	
Mean	1634.884008	Mean	1859.134489
Standard Error	57.22144754	Standard Error	59.33090301
Median	1074.9	Median	1435.9
Mode	446.1	Mode	712.1
Standard Deviation	1303.594498	Standard Deviation	1351.651209
Sample Variance	1699358.616	Sample Variance	1826960.991
Kurtosis	3.183587517	Kurtosis	2.16460034
Skewness	1.778818707	Skewness	1.610664473
Range	7425.4	Range	6422.8
Minimum	247.9	Minimum	378.6
Maximum	7673.3	Maximum	6801.4
Sum	848504.8	Sum	964890.8
Count	519	Count	519

Wednesday			
Purchases		*Sales*	
Mean	1644.440891	Mean	1788.198992
Standard Error	58.77263978	Standard Error	54.66774925
Median	1119.55	Median	1447.65
Mode	438.6	Mode	531.3
Standard Deviation	1335.057738	Standard Deviation	1241.81255
Sample Variance	1782379.164	Sample Variance	1542098.409
Kurtosis	3.286153976	Kurtosis	2.091605188
Skewness	1.804262631	Skewness	1.514846085
Range	7487	Range	6296.1
Minimum	221.4	Minimum	381.6
Maximum	7708.4	Maximum	6677.7
Sum	848531.5	Sum	922710.68
Count	516	Count	516

Thursday			
Purchases		*Sales*	
Mean	1581.156693	Mean	1782.335236
Standard Error	57.47078832	Standard Error	56.9285965
Median	1065.75	Median	1409.05
Mode	314.7	Mode	725.2
Standard Deviation	1295.325784	Standard Deviation	1283.105401
Sample Variance	1677868.887	Sample Variance	1646359.47
Kurtosis	4.87991917	Kurtosis	3.121129344
Skewness	1.986991927	Skewness	1.701073625
Range	9297.3	Range	7825.9
Minimum	242.6	Minimum	307.4
Maximum	9539.9	Maximum	8133.3
Sum	803227.6	Sum	905426.3
Count	508	Count	508

Fridsay			
Purchases		*Sales*	
Mean	1557.916103	Mean	1743.773757
Standard Error	58.34852935	Standard Error	54.56566161
Median	1077.3	Median	1402.4
Mode	469.6	Mode	501.5
Standard Deviation	1308.621065	Standard Deviation	1223.780188
Sample Variance	1712489.091	Sample Variance	1497637.948
Kurtosis	6.031968929	Kurtosis	2.490188691
Skewness	2.15510181	Skewness	1.57739892
Range	9589.5	Range	6221.8
Minimum	238.3	Minimum	323.4
Maximum	9827.8	Maximum	6545.2
Sum	783631.8	Sum	877118.2
Count	503	Count	503

All Days			
purchase		*sales*	
Mean	1592.650103	Mean	1780.057896
Standard Error	26.07732547	Standard Error	25.14983274
Median	1072.8	Median	1413.05
Mode	909.3	Mode	586.1
Standard Deviation	1311.147593	Standard Deviation	1264.513983
Sample Variance	1719108.012	Sample Variance	1598995.612
Kurtosis	4.634934626	Kurtosis	2.655175063
Skewness	1.975120039	Skewness	1.624489
Range	9809.5	Range	8092.7
Minimum	175.2	Minimum	290.1
Maximum	9984.7	Maximum	8382.8
Sum	4026219.46	Sum	4499986.36
Count	2528	Count	2528

Ratio of Odd-lot sales plus purchases to NYSE Volume

Odd lot sales Plus purchases as a percentage of NYSE Trading Volume

Monday	
Mean	0.859209494
Standard Error	0.007591176
Median	0.847670887
Mode	#N/A
Standard Deviation	0.166487489
Sample Variance	0.027718084
Kurtosis	1.74382773
Skewness	0.830752936
Range	1.056023383
Minimum	0.467166705
Maximum	1.523190089
Sum	413.2797664
Count	481

Tuesday	
Mean	0.847380393
Standard Error	0.00836634
Median	0.813161372
Mode	#N/A
Standard Deviation	0.190781905
Sample Variance	0.036397735
Kurtosis	8.108393124
Skewness	1.897000177
Range	1.883920094
Minimum	0.445727227
Maximum	2.329647322
Sum	440.6378043
Count	520

Wednesday	
Mean	0.816533372
Standard Error	0.007352738
Median	0.787599125
Mode	#N/A
Standard Deviation	0.167022106
Sample Variance	0.027896384
Kurtosis	1.3802122
Skewness	0.863342703
Range	1.087120553
Minimum	0.425546933
Maximum	1.512667486
Sum	421.3312198
Count	516

Thursday	
Mean	0.800773688
Standard Error	0.007302768
Median	0.779999737
Mode	#N/A
Standard Deviation	0.164596033
Sample Variance	0.027091854
Kurtosis	2.878434562
Skewness	1.107205442
Range	1.138551451
Minimum	0.409136316
Maximum	1.547687767
Sum	406.7930337
Count	508

Friday	
Mean	0.814842524
Standard Error	0.008001747
Median	0.79045495
Mode	#N/A
Standard Deviation	0.179460482
Sample Variance	0.032206065
Kurtosis	3.360556323
Skewness	1.054218077
Range	1.418388259
Minimum	0.347328555
Maximum	1.765716814
Sum	409.8657893
Count	503

All Days	
Mean	0.8274951
Standard Error	0.003486631
Median	0.802322079
Mode	#N/A
Standard Deviation	0.175305065
Sample Variance	0.030731866
Kurtosis	4.12058539
Skewness	1.209999308
Range	1.982318767
Minimum	0.347328555
Maximum	2.329647322
Sum	2091.907614
Count	2528

Ratio of Odd-Lot Sales Minus Purchase to NYSE Volume

Odd lot sales minus purchases as a percentage of NYSE Trading

Monday

Mean	0.067600579
Standard Error	0.005143351
Median	0.074860671
Mode	#N/A
Standard Deviation	0.112919687
Sample Variance	0.012750856
Kurtosis	3.40890141
Skewness	-0.551693444
Range	1.022076304
Minimum	-0.509484628
Maximum	0.512591676
Sum	32.58347886
Count	482

Tuesday

Column1	
Mean	0.065588822
Standard Error	0.004367946
Median	0.068523917
Mode	#N/A
Standard Deviation	0.099508671
Sample Variance	0.009901976
Kurtosis	2.274181399
Skewness	-0.404882336
Range	0.823055599
Minimum	-0.407291938
Maximum	0.415763661
Sum	34.04059864
Count	519

Wednesday

Column1	
Mean	0.051359982
Standard Error	0.004355293
Median	0.059052368
Mode	#N/A
Standard Deviation	0.098933231
Sample Variance	0.009787784
Kurtosis	2.937819314
Skewness	-0.739044207
Range	0.845290001
Minimum	-0.462352431
Maximum	0.382937571
Sum	26.50175089
Count	516

Thursday

Column1	
Mean	0.06153454
Standard Error	0.004745656
Median	0.063197685
Mode	#N/A
Standard Deviation	0.106961659
Sample Variance	0.011440796
Kurtosis	1.981411624
Skewness	-0.252623207
Range	0.904043417
Minimum	-0.467462808
Maximum	0.436580609
Sum	31.25954651
Count	508

Friday

Column1	
Mean	0.062224714
Standard Error	0.004625034
Median	0.064758664
Mode	#N/A
Standard Deviation	0.103728698
Sample Variance	0.010759643
Kurtosis	2.813107553
Skewness	-0.426960557
Range	0.826822265
Minimum	-0.412708115
Maximum	0.41411415
Sum	31.29903113
Count	503

Tuesday-Friday

Column1	
Mean	0.060166631
Standard Error	0.002263147
Median	0.063417658
Mode	#N/A
Standard Deviation	0.102368327
Sample Variance	0.010479274
Kurtosis	2.479425809
Skewness	-0.438131345
Range	0.904043417
Minimum	-0.467462808
Maximum	0.436580609
Sum	123.1009272
Count	2046

All Days

Column1	
Mean	0.061584021
Standard Error	0.002077993
Median	0.065596184
Mode	#N/A
Standard Deviation	0.10447986
Sample Variance	0.010916041
Kurtosis	2.729466228
Skewness	-0.458727462
Range	1.022076304
Minimum	-0.509484628
Maximum	0.512591676
Sum	155.684406
Count	2528

Odd-lot purchases (sales) as a percent of NYSE Trading Volume

Monday

purchases/volume		*sales/volume*	
Mean	0.396466275	Mean	0.464066853
Standard Error	0.005167738	Standard Error	0.004011351
Median	0.382554493	Median	0.459028834
Mode	#N/A	Mode	#N/A
Standard Deviatio	0.1134551	Standard Deviation	0.088067194
Sample Variance	0.01287206	Sample Variance	0.007755831
Kurtosis	4.464235122	Kurtosis	3.858277649
Skewness	1.498939083	Skewness	1.150176227
Range	0.831719318	Range	0.713406841
Minimum	0.168202511	Minimum	0.25457157
Maximum	0.999921828	Maximum	0.967978411
Sum	191.0967443	Sum	223.6802232
Count	482	Count	482

Tuesday

Mean	0.390269754	Mean	0.455858576
Standard Error	0.004668504	Standard Error	0.004700067
Median	0.372433917	Median	0.437362455
Mode	#N/A	Mode	#N/A
Standard Deviatio	0.106355869	Standard Deviation	0.107074921
Sample Variance	0.011311571	Sample Variance	0.011465039
Kurtosis	3.878958287	Kurtosis	11.31973109
Skewness	1.395599815	Skewness	2.286539481
Range	0.832610427	Range	1.088444609
Minimum	0.140116383	Minimum	0.268475903
Maximum	0.97272681	Maximum	1.356920512
Sum	202.5500023	Sum	236.5906009
Count	519	Count	519

Wednesday			
purchases/volume		***sales/volume***	
Mean	0.382586695	Mean	0.433946677
Standard Error	0.004550138	Standard Error	0.003976419
Median	0.368115224	Median	0.419812514
Mode	#N/A	Mode	#N/A
Standard Deviatio	0.103359265	Standard Deviation	0.090326886
Sample Variance	0.010683138	Sample Variance	0.008158946
Kurtosis	2.989045099	Kurtosis	2.050593391
Skewness	1.140841533	Skewness	1.143517644
Range	0.778971771	Range	0.632052309
Minimum	0.166350052	Minimum	0.232210836
Maximum	0.945321823	Maximum	0.864263146
Sum	197.4147345	Sum	223.9164853
Count	516	Count	516

Thursday			
Mean	0.369619574	Mean	0.431154114
Standard Error	0.00440948	Standard Error	0.004299107
Median	0.353418546	Median	0.418008718
Mode	#N/A	Mode	#N/A
Standard Deviatio	0.099384636	Standard Deviation	0.096896952
Sample Variance	0.009877306	Sample Variance	0.009389019
Kurtosis	2.279969045	Kurtosis	5.040590904
Skewness	1.052482446	Skewness	1.616923979
Range	0.685317406	Range	0.770653831
Minimum	0.155456418	Minimum	0.159757136
Maximum	0.840773824	Maximum	0.930410967
Sum	187.7667436	Sum	219.0262901
Count	508	Count	508

Friday			
purchases/volume		*sales/volume*	
Mean	0.376308905	Mean	0.438533619
Standard Error	0.004793509	Standard Error	0.004442041
Median	0.356189619	Median	0.424274578
Mode	#N/A	Mode	#N/A
Standard Deviatio	0.107507188	Standard Deviation	0.099624587
Sample Variance	0.011557795	Sample Variance	0.009925058
Kurtosis	3.331374191	Kurtosis	5.643606495
Skewness	1.179432325	Skewness	1.50934665
Range	0.840494927	Range	0.846833316
Minimum	0.136202768	Minimum	0.211125787
Maximum	0.976697695	Maximum	1.057959103
Sum	189.2833791	Sum	220.5824102
Count	503	Count	503

Tuesday-Friday			
Mean	0.379772659	Mean	0.43993929
Standard Error	0.002308141	Standard Error	0.002190349
Median	0.363901835	Median	0.42482299
Mode	#N/A	Mode	#N/A
Standard Deviatio	0.104403518	Standard Deviation	0.099075476
Sample Variance	0.010900094	Sample Variance	0.00981595
Kurtosis	3.189131924	Kurtosis	7.072072725
Skewness	1.19800912	Skewness	1.727898905
Range	0.840494927	Range	1.197163376
Minimum	0.136202768	Minimum	0.159757136
Maximum	0.976697695	Maximum	1.356920512
Sum	777.0148595	Sum	900.1157866
Count	2046	Count	2046

All days			
purchases/volume		*sales/volume*	
Mean	0.382955539	Mean	0.444539561
Standard Error	0.002115546	Standard Error	0.001939533
Median	0.367714083	Median	0.429862363
Mode	#N/A	Mode	#N/A
Standard Deviatio	0.106368009	Standard Deviation	0.097518204
Sample Variance	0.011314153	Sample Variance	0.0095098
Kurtosis	3.561931117	Kurtosis	6.442248825
Skewness	1.274574128	Skewness	1.603284779
Range	0.863719061	Range	1.197163376
Minimum	0.136202768	Minimum	0.159757136
Maximum	0.999921828	Maximum	1.356920512
Sum	968.1116038	Sum	1123.79601
Count	2528	Count	2528

APPENDIX 7 – Hourly Data

ALL Days

	Close *Open*	Open *10:00*	10:00 *11:00*	11:00 *12:00*	12:00 *1:00*	1:00 *2:00*	2:00 *3:00*	3:00 *3:30*	3:30 *Close*
Mean	0.0248	-0.0097	-0.0054	0.0077	-0.0001	0.0026	0.0023	0.0085	0.0258
Standard Error	0.0096	0.0050	0.0067	0.0056	0.0048	0.0047	0.0060	0.0049	0.0062
Median	0.0326	-0.0093	0.0000	0.0088	0.0086	0.0067	0.0081	0.0083	0.0350
Mode	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Standard Deviation	0.4828	0.2509	0.3351	0.2792	0.2402	0.2331	0.2984	0.2471	0.3119
Sample Variance	0.2331	0.0629	0.1123	0.0780	0.0577	0.0544	0.0890	0.0611	0.0973
Kurtosis	11.3854	4.8214	3.4536	24.8922	18.8194	6.8524	4.8421	4.3532	14.1786
Skewness	-0.5263	0.3998	-0.1871	1.3661	-1.3129	-0.7282	-0.0867	-0.1424	-1.2356
Range	8.1500	3.6253	4.4827	6.0249	4.7334	3.3678	3.8786	3.5360	5.4428
Minimum	-3.9885	-1.2830	-1.8039	-1.7001	-3.4351	-2.0886	-1.9292	-1.7610	-3.4043
Maximum	4.1615	2.3423	2.6788	4.3247	1.2983	1.2792	1.9494	1.7751	2.0385
Sum	62.5853	-24.3685	-13.5995	19.3876	-0.2492	6.6297	5.7384	21.2983	64.7443
Count	2527	2524	2524	2525	2513	2508	2505	2505	2505
Confidence Level(95.0%)	0.0188	0.0098	0.0131	0.0109	0.0094	0.0091	0.0117	0.0097	0.0122

Monday

Mean	-0.0058	0.0429	0.0171	0.0232	0.0105	0.0136	0.0114	0.0146	0.0279
Standard Error	0.0246	0.0118	0.0153	0.0107	0.0088	0.0106	0.0130	0.0100	0.0158
Median	0.0136	0.0446	0.0313	0.0199	0.0181	0.0116	0.0256	0.0078	0.0493
Mode	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Standard Deviation	0.5408	0.2584	0.3354	0.2341	0.1933	0.2328	0.2845	0.2195	0.3461
Sample Variance	0.2925	0.0667	0.1125	0.0548	0.0374	0.0542	0.0810	0.0482	0.1198
Kurtosis	14.4357	15.4563	2.5396	1.5958	2.0278	15.3453	5.9937	2.3474	38.3311
Skewness	-1.2076	1.9192	-0.6868	0.1783	-0.2611	-1.1016	-0.9896	0.1286	-4.0558
Range	7.4270	3.1967	2.8260	1.9853	1.6486	3.1065	2.8191	1.6778	4.3097
Minimum	-3.9885	-0.8544	-1.8039	-0.7964	-0.8326	-2.0886	-1.9292	-0.8127	-3.4043
Maximum	3.4385	2.3423	1.0221	1.1889	0.8160	1.0179	0.8899	0.8651	0.9054
Sum	-2.7830	20.6503	8.2046	11.1464	5.0495	6.5131	5.4400	6.9944	13.3857
Count	482	481	481	481	482	480	479	479	479
Confidence Level(95.0%)	0.0484	0.0231	0.0301	0.0210	0.0173	0.0209	0.0255	0.0197	0.0311

TUESDAY

Mean	0.0416	-0.0260	0.0024	-0.0009	-0.0068	-0.0009	0.0069	0.0233	0.0242
Standard Error	0.0202	0.0104	0.0148	0.0123	0.0105	0.0100	0.0144	0.0109	0.0137
Median	0.0341	-0.0260	0.0000	-0.0059	0.0078	-0.0076	0.0065	0.0208	0.0347
Mode	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Standard Deviation	0.4600	0.2362	0.3366	0.2797	0.2393	0.2260	0.3270	0.2475	0.3115
Sample Variance	0.2116	0.0558	0.1133	0.0782	0.0572	0.0511	0.1069	0.0613	0.0970
Kurtosis	18.5040	1.0812	8.6380	5.1241	5.7367	2.9109	3.2838	2.4783	4.1902
Skewness	0.5970	0.3384	0.6654	0.4791	-0.4735	0.2548	0.4056	0.5041	-0.8908
Range	7.4492	1.6865	4.0067	2.8594	2.7950	2.2136	3.1759	1.9074	2.9198
Minimum	-3.2877	-0.6636	-1.3279	-1.2612	-1.5304	-0.9344	-1.4149	-0.6621	-1.9169
Maximum	4.1615	1.0230	2.6788	1.5982	1.2646	1.2792	1.7610	1.2453	1.0029
Sum	21.5369	-13.4206	1.2334	-0.4403	-3.5147	-0.4750	3.5765	12.0240	12.4609
Count	518	517	517	517	516	515	515	515	515
Confidence Level(95.0%)	0.0397	0.0204	0.0291	0.0242	0.0207	0.0196	0.0283	0.0214	0.0270

WEDNESDAY

Mean	0.0201	-0.0060	-0.0165	0.0176	0.0192	-0.0076	-0.0110	0.0101	0.0284
Standard Error	0.0178	0.0102	0.0147	0.0113	0.0099	0.0110	0.0132	0.0121	0.0126
Median	0.0207	0.0000	-0.0170	0.0200	0.0172	0.0056	0.0000	0.0212	0.0331
Mode	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Standard Deviation	0.4047	0.2308	0.3329	0.2573	0.2246	0.2488	0.3002	0.2756	0.2869
Sample Variance	0.1638	0.0533	0.1108	0.0662	0.0505	0.0619	0.0901	0.0760	0.0823
Kurtosis	9.0082	1.1295	2.1215	2.0261	2.6897	9.4664	5.0386	5.3009	2.5941
Skewness	-1.1645	-0.0747	-0.1322	-0.3743	0.3822	-1.5994	-0.4751	-0.9039	0.0729
Range	4.4455	1.7810	2.9332	2.2986	2.0649	2.4280	3.3522	2.7988	2.6700
Minimum	-2.7940	-0.9553	-1.5176	-1.3994	-0.7666	-1.7780	-1.6483	-1.7610	-1.1219
Maximum	1.6515	0.8258	1.4156	0.8992	1.2983	0.6500	1.7040	1.0379	1.5482
Sum	10.3607	-3.1107	-8.5014	9.0941	9.8648	-3.9257	-5.6608	5.2182	14.6458
Count	516	516	516	516	515	515	515	515	515
Confidence Level(95.0%)	0.0350	0.0200	0.0288	0.0222	0.0194	0.0215	0.0260	0.0239	0.0248

THURSDAY

Mean	0.0102	-0.0275	-0.0101	-0.0153	-0.0152	0.0109	-0.0083	-0.0080	0.0253
Standard Error	0.0214	0.0107	0.0149	0.0119	0.0103	0.0099	0.0124	0.0116	0.0135
Median	0.0092	-0.0338	0.0122	0.0000	0.0000	0.0173	-0.0167	0.0000	0.0284
Mode	0.0000	#N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Standard Deviation	0.4814	0.2415	0.3350	0.2680	0.2321	0.2223	0.2788	0.2601	0.3034
Sample Variance	0.2317	0.0583	0.1122	0.0718	0.0538	0.0494	0.0777	0.0677	0.0921
Kurtosis	11.3850	1.7590	2.2259	3.4019	2.0149	1.0347	4.6167	6.2356	6.4209
Skewness	-0.3566	-0.2406	-0.5230	-0.5370	-0.3411	-0.2169	0.3965	0.0360	0.2729
Range	6.2683	2.0697	2.8320	2.7674	1.8460	1.5269	2.8485	3.0850	3.5499
Minimum	-2.6354	-1.2830	-1.6842	-1.7001	-1.0163	-0.8382	-0.9075	-1.3099	-1.5114
Maximum	3.6328	0.7867	1.1478	1.0673	0.8297	0.6887	1.9411	1.7751	2.0385
Sum	5.1574	-13.9042	-5.1146	-7.7321	-7.6951	5.5064	-4.1799	-4.0435	12.7351
Count	507	506	506	507	505	504	504	504	504
Confidence Level(95.0%)	0.0420	0.0211	0.0293	0.0234	0.0203	0.0195	0.0244	0.0228	0.0266

FRIDAY

Mean	0.0553	-0.0288	-0.0192	0.0152	-0.0083	-0.0017	0.0137	0.0023	0.0242
Standard Error	0.0232	0.0125	0.0150	0.0153	0.0134	0.0106	0.0135	0.0102	0.0141
Median	0.0835	-0.0273	-0.0166	0.0300	0.0000	0.0000	0.0163	-0.0087	0.0354
Mode	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Standard Deviation	0.5199	0.2796	0.3357	0.3430	0.2986	0.2350	0.2982	0.2258	0.3122
Sample Variance	0.2703	0.0782	0.1127	0.1177	0.0891	0.0552	0.0889	0.0510	0.0975
Kurtosis	2.6046	1.7198	1.7293	50.0411	35.1252	3.6815	6.0400	2.0759	4.2304
Skewness	-0.3858	-0.0186	-0.3166	3.8155	-3.1133	-0.6341	-0.0090	-0.0758	-0.3223
Range	4.1108	2.3184	2.5940	5.7231	4.3207	2.2859	3.4095	1.9423	3.1073
Minimum	-2.0531	-1.0613	-1.3866	-1.3984	-3.4351	-1.4789	-1.4600	-1.0891	-1.5040
Maximum	2.0578	1.2571	1.2074	4.3247	0.8857	0.8070	1.9494	0.8531	1.6033
Sum	27.8116	-14.4723	-9.6547	7.6401	-4.0889	-0.8300	6.7406	1.1265	11.8741
Count	503	503	503	503	494	493	491	491	491
Confidence Level(95.0%)	0.0455	0.0245	0.0294	0.0300	0.0264	0.0208	0.0264	0.0200	0.0277